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Division of Agricultural Sciences

UNIVERSITY OF CALIFORNIA

AN ECONOMIC ANALYSIS OF THE FEASIBILITY OF PROCESSING POTATOES IN CALIFORNIA

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GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS

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SUMMARY

There has been a considerable expansion of potato processing in Idaho and several other states during the last ten years. Although California ranks third in the United States in production of potatoes the industry would face many difficulties should it attempt to establish processing operations.

Production and Utilization: United States

The acreage of potatoes harvested in the United States declined 61 percent between 1910 and 1960, from 3.6 million to 1.4 million. Yield per acre, in contrast, increased about 210 percent, from 56.3 hundredweights to 176.5 hundredweights. Thus, despite the acreage decline, the volume of potatoes harvested rose 23 percent, from 205 million hundredweights to 253 million hundredweights. Most of these changes have occurred since 1935.

Use of potatoes has also changed significantly. Domestic consumption accounted for about 75 percent of the total supply in both 1940 and 1960. Processing, in contrast, used less than 2 percent in 1940, and nearly 23 percent in 1960.

Production: California and Idaho

In contrast to the national decline in acreage harvested, acreage in potatoes in California and Idaho have increased appreciably since 1940. Yields per acre have also increased in these two states. Thus, the output relative to total United States production has increased markedly--from 15.5 percent in the five-year period 1940-1944, to 27.2 percent in 1955-1959. In California, most of the increase of acreage occurred between 1940 and

1945; since then the upward trend has been only moderate. In Idaho, in contrast, most of the increase of acreage has occurred in the past ten years (1950-1960), and from all accounts it will continue to rise during the 1960's (Figure 3).

Potatoes are produced commercially in about 21 of the 58 counties of California, but 56 percent of the acreage is in the southern San Joaquin Valley. Kern County alone accounts for 47 percent of the state's total. Another 20 percent is in the interior valleys of southern California, 13 percent in the central coast region, and 10 percent in the northern mountain counties.

Harvest in California is throughout the year. About 80 percent of all shipments of fresh potatoes, however, take place in the five-month period April to August, with 70 percent in May, June, and July. The shipments are heavily concentrated because potatoes produced in the hot interior valleys have to be harvested and shipped as soon as they reach or approach maturity. Potatoes produced in the late spring and summer months are usually not held in storage. It is estimated that 70 percent of all potatoes produced in California are of the Long White varieties.

In Idaho, potatoes are produced commercially in all counties but over 75 percent of the total acreage is in the southern part of the state, along or near the Snake River. Concentration is highest in the southeastern section, where potatoes, overwhelmingly of the Russet Burbank type, are harvested in the fall. These potatoes can be stored on the farm or in warehouses for relatively long periods (7-10 months), especially if sprout inhibitors are used. Because of the long storage period, shipments of

fresh potatoes can be extended over a much longer period than is possible in California. By the same token, potatoes are available for 7-10 months each year for processing.

The belief is rather widespread that the cost of producing potatoes is much lower in Idaho than in California. A careful comparison of costs per hundredweight of production in Idaho includes costs only up to harvesting and into on-farm storage, whereas in California cost computations include delivery to and expenses in packing sheds. If delivery and packing shed costs are eliminated from California computations, costs are more nearly equal in the two states. Although costs per acre are lower in Idaho the higher yields per acre in California serve to lower costs per hundredweight.

The Demand for Processed Potatoes

During the past two decades food consumption patterns have changed markedly. Housewives, hotels, restaurants, and hospitals have been purchasing an expanding proportion of their food requirements in pre-prepared, concentrated, and less-perishable form. Important factors contributing to the shift have been convenience of preparation and higher buying power. This change has been accomplished by the development of a wide variety of food processing industries and in radical changes in methods of merchandising foods through wholesale channels and retail outlets. Continuous attention has been given to quality and consumer acceptance of processed convenience foods, especially of frozen or pre-cooked items.

Potato processing is a relatively new development in food processing. The big expansion has come in the past ten years and, for some types of

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processed potato products, in the last five years. In 1951, about 30 million bushels of potatoes were manufactured into processed food products; in 1960, about 97 million bushels. Projections of the National Potato Council indicate a several-fold further increase by 1970.

Already on the market are more than 30 different types of potato products, and new forms are being devised and market-tested. Three main categories are involved:

1. Chipped potatoes. In volume, this is still the most important processed potato product. Processing facilities are widely distributed throughout the United States, usually in or near population centers.
2. Dehydrated potatoes. These are principally in flake or granule form for making of mashed potatoes, or in diced form for sale to processors of soups, hash, and so on.
3. Frozen potato products. These are principally frozen French fries.

Available information indicates that about 70 percent of the dehydrated and frozen potato products move to the institutional trade. Even so, the relative proportion going to the retail trade has increased in recent years, and projections indicate further increases for the late 1960's.

So far, there is little indication that processed potato products have replaced fresh potatoes. Potato consumption per capita has been declining for at least fifty years, but in the last decade appears to have leveled off. There is reason to believe that increased consumption of processed potatoes has tended to supplement rather than replace fresh use. Nevertheless, people familiar with the potato industry lean strongly to the view that

fresh consumption per capita will decline as institutions and housewives become more familiar with the advantages of processed potatoes. Meanwhile, processing firms are giving much attention to quality improvement and packaged products that will better meet convenience and taste preferences. It is probable too that as more processing firms enter the market and as processing technology becomes more stabilized there will develop a downward pressure on prices to both the institutional and retail trades.

Unlike the wide dispersion of chip plants, the processing of dehydrated and frozen potato products concentrated in a few states, the most important being Idaho and Maine. In 1959 Idaho accounted for 70 percent of the national output of these two categories of processed potato products; by 1961, several new plants will be in operation. Because of the importance of Idaho, special attention is given to development of the potato processing industry there.

Potato Processing in Idaho

In 1959, about 31 percent of the total potato crop of Idaho (43 percent of the supply available for food use) was used in processing, including relatively small supplies of chipped and canned potatoes. In 1960, it is estimated, 35 to 40 percent of the total crop will be processed.

In 1959, there were 9 firms with 11 plants engaged in processing dehydrated and frozen potato products. Average volume of raw products (potatoes) handled per plant was around one million hundredweights. In 1960, eight additional plants were in operation, under construction, or projected for 1961.

The officials of processing plants in Idaho were reluctant to give any indication of the amount of capital in plant and equipment necessary for product and market development. Most officials said that annual obsolescence costs on new equipment were very high because processing of many new types of products was still largely in the experimental stage. Information from other industry sources indicates that a frozen potato-products plant would require an investment of 1.5 million dollars for building and equipment plus at least another million dollars for working capital. Investment in buildings and equipment for a plant for processing dehydrated products would probably be around one million dollars plus working capital. Assuming, conservatively, an average investment of 2.5 million dollars a plant, the 18 plants that may be in operation in 1961 will have a combined investment of over 40 million dollars. Rough as these figures are, they give some idea of what it may cost to establish an extensive potato processing industry in California.

Potato processing plants in Idaho are operated 9-10 months a year, much of the time on a three-shift (24-hour) basis. Careful quality control is maintained as products move through the plant. In addition, most firms maintain research departments to devise new equipment and products, to improve quality, and to market test products. Large volumes of water are used in processing operations. Water is available in abundant supply and at relatively low cost. Some of the processing firms have highly integrated operations. These may include farm production of potatoes, manufacture of dehydrated and frozen potato products and of by-products for nonfood uses, shipment of fresh potatoes, and close connections with the wholesale trade.

Processed potato products are sold by processors to the institutional trade, mainly through food brokers, and to the wholesale-retail trade, partly through brokers and partly through large full-line food manufacturers' wholesale outlets. Products may be packaged in containers bearing the trade name of the processor or the trade name of the main volume buyers.

During the last two years, several processing firms in Idaho found it necessary to augment local supplies of potatoes, especially at the beginning (August-September) and end (May-June) of the plant operating year with potatoes from adjacent states, including California. With 6-8 new plants by 1961, it is highly probable that large quantities of potatoes will have to be shipped in from nearby states during the next few years.

Suggested Action

In view of the problems the California industry must solve before undertaking a processing program for potatoes, and in view of the four- or five-year period of grace before processed potatoes compete strongly with California early potatoes, the following procedure might be considered.

1. The industry should cooperate with the Western Regional Research Laboratory and the California Agricultural Experiment Station in further experimentation with and testing of potato varieties for processing, and in developing new and improved processing techniques and methods for quality maintenance and control.
2. If the experimental program indicates that a processing industry in California is technically feasible, the industry might contract with one or two established processing firms in Idaho for commercial test of the yield-cost relationships and marketability of processed California-grown potatoes.

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3. If the contract procedure is not feasible, the California industry might consider establishing, for its own commercial testing, a pilot processing plant in or near the Kern County producing area. This alternative might prove more costly than the contract procedure.
4. If commercial tests of the production, processing, quality, and marketability of California potatoes are favorable, and the timing is right in terms of the supply-demand outlook for processed potatoes, the industry could well afford to encourage and even support financially the establishment of a potato processing industry within the State. In fact, grower and shipper participation in financing and planning the industry's processing program would seem a prerequisite to obtaining capital for such a business venture.

AN ECONOMIC ANALYSIS OF THE FEASIBILITY OF PROCESSING POTATOES IN CALIFORNIA

J. M. Tinley[1] and D. B. DeLoach[1]

INTRODUCTION

Reasons for the Study

During the first half of 1960 the Potato Growers Association of California and Arizona requested the University of California to undertake a study of the feasibility of processing potatoes in California. In submitting its request, the association drew attention to the rapid expansion of potato processing in competing potato producing areas. Information was specifically requested on (a) the suitability of California potatoes for processing, (b) sources of supply, (c) the form of organization that would be most advantageous in undertaking processing operations, (d) needed capital outlay and methods of financing, and (e) potential trade outlets for processed potato products.

Questions to be Answered

A preliminary survey of the literature on the development of potato processing in the United States and of sales of such products indicated a need for answers to additional questions in order to answer those posed by the Potato Growers Association of California and Arizona:

1. What have been the trends in acreage, yield per acre, production, and use of potatoes in the United States?

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[1] Professors of Agricultural Economics, Agricultural Economists in the Experiment Station and on the Giannini Foundation, University of California, Davis, California.

2. What is likely to be the future consumption trend for processed potato products in the United States, and how is this likely to affect the demand for fresh potatoes?
3. What has been the trend in the processing of potato products, and why has Idaho become the most important processing state?
4. How many processing plants are there in Idaho? Is the number or size of processing plants likely to increase?
5. What has been the experience of potato processing firms in Idaho in developing new products, equipment, and market outlets?
6. How much capital is needed for constructing and equipping processing plants of different sizes, and for different products, and for developing the market?

In the light of the answers to these questions, what would be some of the basic problems in establishing potato processing in California? In particular,

- a. How are the various trends in the production and processing of potatoes likely to affect the demand for fresh potatoes from California?
- b. If the effect is likely to be adverse, how many and what size of processing plants would have to be established in California, and where should such plants be located?
- c. What processed products could be manufactured economically in the short and long run?
- d. What capital investments would have to be made in plant and equipment, and how much capital would be needed for financing operations and for market development?

e. Would it be economically feasible to modify the seasonal, locational, and varietal pattern of potato production in California?

Sources of Information

The information on yields per acre, total production, and carlot shipments of potatoes was obtained from various reports of the U.S. Department of Agriculture. Members of the Department of Vegetable Crops of the Agricultural Extension Service were helpful in supplying information on varieties of potatoes grown in different areas of California and on cultural practices. Data on the suitability of different varieties of potatoes for processing, types of processed potato products, and processing techniques were obtained from the Department of Food Science and Technology, University of California, Davis, and from personnel of the Western Regional Research Laboratory, U.S. Department of Agriculture, at Albany, California. An exhaustive search was made of publications of the U.S. Department of Agriculture, Land-Grant Colleges, and trade papers on trade, institutional, and consumer acceptance of various types of processed potato products.

A preliminary analysis of potato production in the United States indicated that two states, California and Idaho, produced about 27.2 percent of the total annual output of potatoes in the United States. Idaho alone accounted for 15.4 percent of the total. Furthermore, information from various sources indicated that a large proportion of processed potato products were manufactured in Idaho. Therefore, it was decided that some time should be spent in Idaho to survey potential production of potatoes in that state, the operations of processing firms, capital costs in processing plants, and methods of merchandising processed potato products.

In addition, discussions were held with a number of potato growers and shippers, with officials in one of the banks, and with several other persons with a knowledge of certain phases of potato production and processing.

Organization

The first part of this study analyzes trends in potato production in the United States and the states of California and Idaho. Included is an analysis of areas of production in California and Idaho--seasonal variation of production and fresh shipments.

The second part of this study evaluates trade and consumer acceptance of processed potato products, and probable trends in consumption or use. Lack of data on volume output of processed products makes much of the analysis qualitative rather than quantitative.

Next, attention is given to characteristics of potato processing in Idaho. Consideration is given to features of the potato processing industry--number of firms and plants, size of operating facilities, varieties of processed products, source of supplies, and trade outlets. Here again, much of the information is qualitative rather than quantitative, because information is lacking on capital investments in processing facilities.

In the final two sections, the information already presented is evaluated in terms of the feasibility of processing potatoes in California. Several alternative courses are suggested. Consideration is given to the feasibility of expanding California production of other varieties, and of expanding production in other areas so as to assure a more even supply through the year.

PRODUCTION FACTORS

United States

During the past fifty years, the acreage of potatoes harvested annually in the United States has declined about 61 percent--from 3,644,000 acres in 1910 to 1,434,000 acres in 1960 (Table 1 and Figure 1). Most of the decline has been since 1935. Yield per acre, in contrast, has increased more than three-fold since 1910. Most of the increase has been since 1935.

Because yields per acre increased more than the decline in acreage harvested, production has shown a distinct (23 percent), though irregular, upward trend--from 205 million hundredweights in 1910 to 253 million hundredweights in 1960.

United States population, meanwhile, has increased 92 percent, from 92,400,000 to 177,100,000. The much slower increase in potato production than population growth means that the output of potatoes per capita declined sharply, from 222 pounds to 143 pounds.

Use of Potatoes

Potato use has changed markedly during the past twenty years (Table 2). In the 1940 crop year the total supply of potatoes (domestic production plus imports) amounted to 227 million hundredweights, of which 55 million were exported or went to nonfood uses (Table 2). Of the 172 million bushels available for food, 169 million hundredweights were used fresh, and 3.2 million were processed. In the 1960 crop year the total available supply had increased to 257 million hundredweights of which 64 million were exported or went to nonfood purposes. Of the total of 193.5 million hundredweights

TABLE 1

Potatoes - U.S. Acreage, Yield per Acre, Production, Value of Production, Price per Cwt., and Production per Capita
(By 5-year intervals--1910-1960)

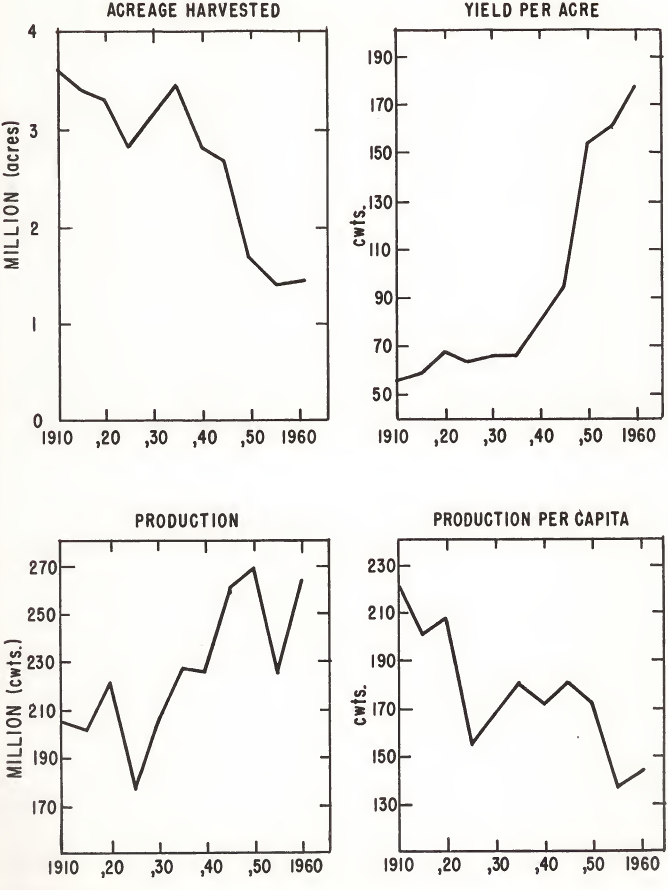
Year	Acreage harvested (1,000 acres)	Yield per acre (cwts.)	Production (million cwts.)	Value of production (million dollars)	Value per cwt. (dollars)	Population a/ (millions)	Production per capita (pounds)
1910	3,644	56.3	205.2	201.1	.98	92.4	222
1915	3,433	58.9	202.1	229.3	1.14	100.5	201
1920	3,301	67.1	221.3	462.3	2.09	106.5	208
1925	2,810	63.3	177.9	505.5	2.84	115.8	154
1930	3,139	65.7	206.3	312.5	1.51	123.1	168
1935	3,469	65.5	227.3	222.4	.98	127.2	179
1940	2,832	79.9	226.2	198.1	.88	132.0	171
1945	2,664	94.4	251.6	588.3	2.34	139.6	180
1950	1,698	152.6	259.1	394.4	1.52	151.7	171
1955	1,414	160.6	227.0	403.3	1.78	165.3	137
1960 b/	1,434	176.5	253.2	--	--	177.1	143

a/ Population estimates as of July 1 of each year and includes armed forces overseas.

b/ Preliminary.

Source: U.S. Department of Agriculture, Potatoes, estimates in cwts. by states, 1866-1953; U.S. Department of Agriculture, Potatoes and Sweet Potatoes, 1949-1958; U.S. Bureau of Census, Historical Statistics of U. S. 1789-1952 and Statistical Abstract 1959.

Figure I. U. S. Production of Potatoes (1910 –1960).



Source: Table I.

TABLE 2

Production and Utilization of Potatoes - 1940 and 1960

	1940 Crop year	1960 Crop year	Percentage utilization of tot. supply	
			1940	1960
	1,000 cwts.[a]			
Production	226,152	256,266		
Imports	558	1,200		
Total supply	226,710	257,466	100.00	100.00
Total exports (including two territories)	2,570	3,540	1.13	1.37
Used for seed	25,191	21,000	11.11	8.16
Feed to livestock, shrinkage and loss	22,343	29,400	9.85	11.42
Made into starch	4,818	10,020	2.12	3.89
Exports and nonfood uses	54,921	63,960	24.22	24.84
Total available for food use	171,788	193,506	75.78	75.16
Used as fresh potatoes	168,548	135,306	74.34	52.55
Processed				
As flour	240	1,500	.11	.58
Dehydrated	--	13,620	--	5.29
Canned	--	900	--	.35
For hash, stews, and soups	300	1,500	.13	.58
Frozen French fries	--	12,480	--	4.85
Potato chips	2,700	28,200	1.20	10.95
Total processed	3,240	58,200	1.44	22.60

[a] Data supplied by National Potato Council were in bushels. Converted to hundredweights by authors at 60 pounds per bushel.

Source: Estimates of National Potato Council.

available for food, only 135.3 used fresh, whereas 58.2 million were processed. Thus, the proportion processed increased from 1.43 percent of the total supply in 1940, to 22.60 percent in 1960.

Trends: United States, California, and Idaho

Since 1940, California and Idaho have grown in importance in United States total production of potatoes. In the five-year period, 1940-1944, these two states accounted for 15.5 percent of total production; in 1955-1959 the percent was 27.2 (Table 3 and Figure 2). United States production showed an upward, though irregular, trend between 1940 and 1946, a sharp downward trend from 1946 to 1951, and a moderate upward trend between 1951 and 1960.

In California, production of potatoes, in contrast, increased sharply between 1940 and 1946; since then the trend has been moderately upward. In Idaho the trend was moderately upward between 1940 and 1954, and sharply upward since then.

These contrasting trends in United States, California, and Idaho production are related largely to trends in acreage. As stated earlier, United States potato acreage has declined appreciably during the past fifty years, in 1955-1959 being only about half the acreage in 1940-1944 (Table 3 and Figure 3). In California, in contrast, the average acreage of 81,000 in 1940-1944 expanded to 112,000 in 1945-1949. Large annual fluctuations since then have established no appreciable trend. In Idaho the average acreage of 148,000 in 1940-1944 expanded to 162,000 in 1945-1949, declined to 151,000 in 1950-1954, and rose again in 1955-1959 to 190,000. Taking California and Idaho together the average acreage harvested in 1955-1959 was 31 percent greater than in 1940-1944 (301,000 vs. 229,000). This contrasts with the 50 percent decline in the United States as a whole.

TABLE 3

Potatoes: Acreage, Yields, Production--Farm Value
U.S.A., Idaho and California

	Acreage harvested (1,000 acres)			Yield per acre (cwts.)			Production (million cwts.)			Value per cwt.			As percent of U.S. production	
	U.S.A.	Idaho	Calif.	U.S.A.	Idaho	Calif.	U.S.A.	Idaho	Calif.	U.S.A.	Idaho	Calif.	Idaho	Calif.
1940	2,832	128	70	79.9	153	187	226.2	19.6	13.1	.88	.40	1.17		
1941	2,693	122	71	79.3	135	165	213.4	16.5	11.7	1.31	1.22	1.23		
1942	2,671	133	69	82.9	138	201	221.3	18.4	13.9	1.91	1.45	2.30		
1943	3,239	189	90	85.0	138	186	275.3	26.1	16.7	2.14	1.45	2.42		
1944	2,780	168	103	82.9	142	202	230.4	23.8	20.7	2.45	1.70	2.38		
5-yr. avg.	2,843	148	81	82.0	141	188	233.3	20.9	15.2	1.74	1.24	1.90	9.0	6.5
1945	2,664	205	119	94.4	135	185	251.6	27.7	22.0	2.34	1.57	2.55		
1946	2,527	178	119	115.7	156	233	292.4	27.8	27.8	2.04	1.52	2.22		
1947	2,001	130	96	116.6	132	237	233.4	17.2	22.8	2.69	2.63	2.82		
1948	1,981	152	121	136.3	180	232	269.9	27.4	28.0	2.55	2.00	2.63		
1949	1,755	147	107	137.3	148	242	241.0	21.8	25.9	2.13	1.69	2.41		
5-yr. avg.	2,186	162	112	120.1	150	226	257.7	24.4	25.3	2.35	1.88	2.53	9.5	9.8
1950	1,698	164	121	152.6	186	232	259.1	30.5	28.0	1.52	.85	1.88		
1951	1,348	131	88	145.2	176	249	195.8	23.1	21.8	2.70	2.25	2.53		
1952	1,397	141	96	151.1	192	252	211.1	26.9	24.3	3.25	2.50	3.93		
1953	1,536	164	130	150.8	187	225	231.7	30.7	29.3	1.31	.96	1.66		
1954	1,413	154	95	155.4	173	245	219.5	26.6	23.4	2.16	1.89	2.63		
5-yr. avg.	1,478	151	106	151.0	183	241	223.4	27.6	25.4	2.19	1.69	2.53	12.4	11.4
1955	1,414	170	116	160.6	195	252	227.0	33.0	29.2	1.78	1.39	2.00		
1956	1,386	177	107	175.9	187	242	243.7	33.1	25.9	2.01	1.15	3.72		
1957	1,383	184	114	173.3	204	274	239.5	37.4	31.2	1.94	1.52	1.52		
1958	1,467	208	122	181.1	210	242	265.7	43.8	29.6	1.32	1.00	1.82		
1959	1,392	210	97	174.5	191	283	243.0	40.2	27.5	2.27	2.10	2.83		
5-yr. avg.	1,408	190	111	173.1	197	259	243.8	37.5	28.7	1.86	1.43	2.38	15.4	11.8

Source: U.S. Department of Agriculture, Potatoes, 1866-1953, Stat. Bul. No. 251, June 1959; U.S. Department of Agriculture, Potatoes and Sweet Potatoes, 1949-1955, 1955-1956, 1956-1957, and 1957-1958; Kern County Potato Growers Association, 1959 Yearbook; Potato Growers Association of California and Arizona, 1960 Yearbook.

Figure 2. Potatoes: Production, Million Cwts.
U. S., Idaho and California.

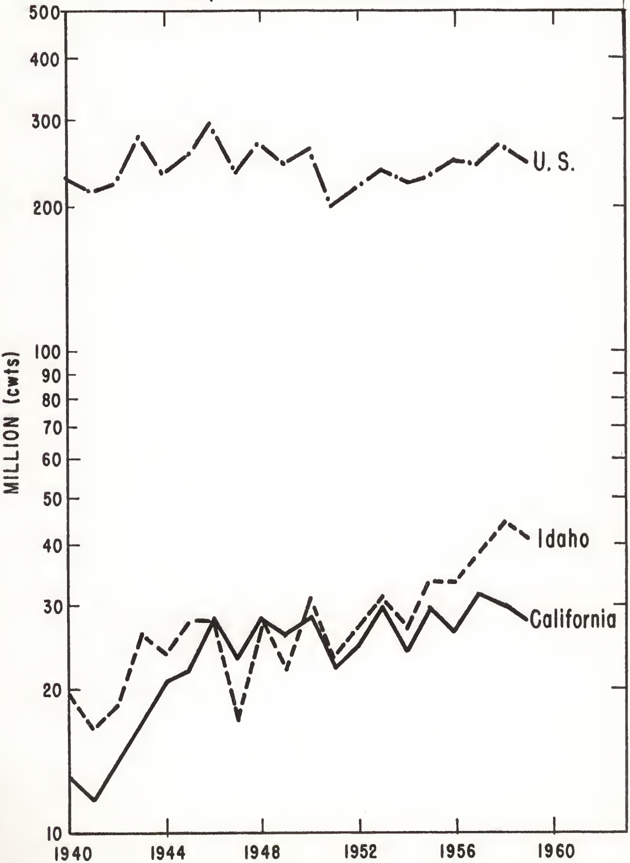
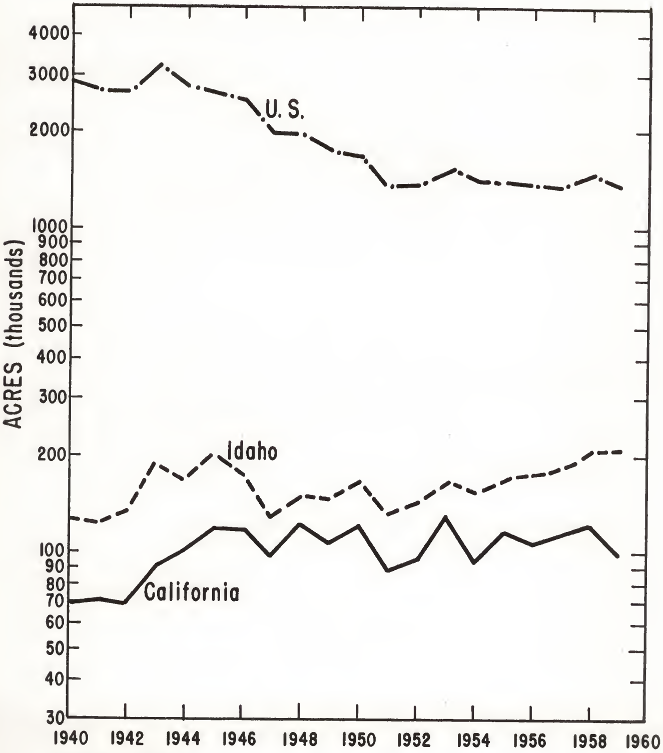


Figure 3. Potatoes: Acreage Harvested, U. S. A., Idaho and California, 1940-1959.



Source: Table 2.

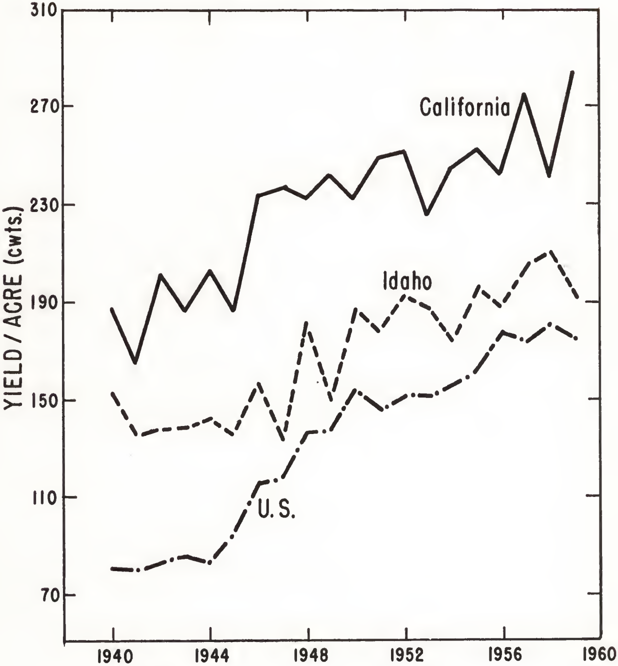
There is every reason to believe that potato acreages in Idaho will continue to increase in the 1960's. The preliminary estimate for 1960 was 220,000 acres, compared with 210,000 acres in 1959. Much new land is being prepared for potato production, according to information from the Federal State Crop Reporting Service, from members of the Agricultural Extension Service, and from personnel of potato processing firms in Idaho. Much of the new land is in producing units ranging from several hundred to several thousand acres. In much of the older producing areas the producing units vary from 40-160 acres. Water is plentiful, since most of the potato producing areas (new as well as old) are adjacent to the Snake River. Some Idaho estimates forecast 300,000 acres in potatoes by 1970.

In California the acreage trend is more obscure. The reasons are explained more fully later. It is significant that acreage harvested in California has shown no definite trend--up or down--since 1945.

Since 1940, potato yields per acre have increased more rapidly in the United States as a whole than in either California or Idaho (Table 3 and Figure 4). The United States average was 173.1 hundredweights in 1955-1959, compared with 82.0 hundredweights in 1940-1944. This increase of 111 percent is in contrast with 38 percent for California and 40 percent for Idaho.

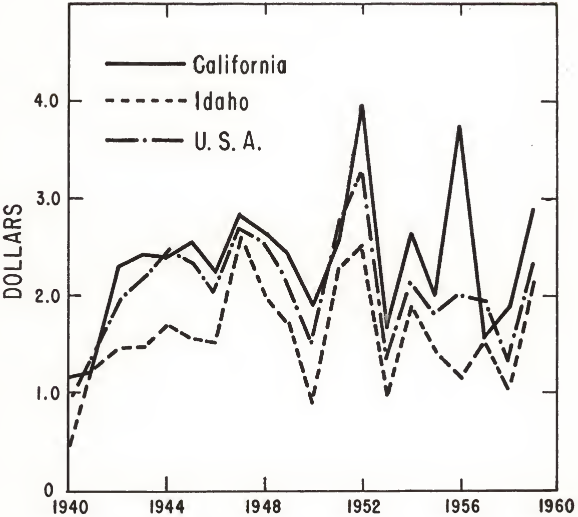
The unadjusted farm value of potatoes per hundredweight has fluctuated violently since 1940--from a United States low of 88 cents in 1940 to a United States high of $3.25 in 1952 (Table 3 and Figure 5). Average value was $1.74 in 1940-1944, $2.35 in 1945-1949, and $1.84 in 1955-1959. In Idaho the trend was similar. In California the farm value of potatoes averaged $2.53 per hundredweight in 1945-1954 as compared with the $1.90 during the first five-year period and $2.39 during the last five-year period.

Figure 4. Potatoes: Yield in California, Idaho, and the United States. 1940 – 1959.



Source: Table 2.

Figure 5. Potatoes: Value Per Cwt., U.S.A., Idaho, and California.



Source: Table 2.

Except in a few years, the farm value of potatoes was lowest in Idaho and highest in California. Because most California potatoes are shipped in late spring (May-July), when competition with other potato growing areas is at a minimum, California has enjoyed a relatively favorable price position.

Location of Production in California

Potatoes are grown on a commercial scale in 21 of the 58 counties in California, but a relatively few counties dominate. Kern County comes first, with 46.7 percent of total acreage in the crop year, 1958-1959. Next is Riverside, with 13.5 percent, followed by San Joaquin, Modoc, and Siskiyou counties (5 to 6 percent) and Tulare and Monterey counties (4 to 4.5 percent). These seven counties account for about 85 percent of the total potato acreage in California (Table 4 and Figure 6).

The state can be divided into four main potato producing regions: the San Joaquin Valley (exclusive of San Joaquin County[1/]), with 56.3 percent of the total acreage in 1958-1959; the southern California regions, with 19.9 percent; the central coast region (plus San Joaquin County), with 12.7 percent; and the northern mountain counties, with 10.6 percent.

Although potatoes are harvested all the year round in California, nearly 53 percent of the total crop is produced in late spring (April-July). The early summer (July-August) and the late summer (August-October) each accounts for about 11 percent, the fall (September-November) for 17 percent, and the winter (November-March) for 8 percent.

[1/] San Joaquin County is grouped with the Central Coast counties because its seasonal production pattern conforms to that of this region.

TABLE 4

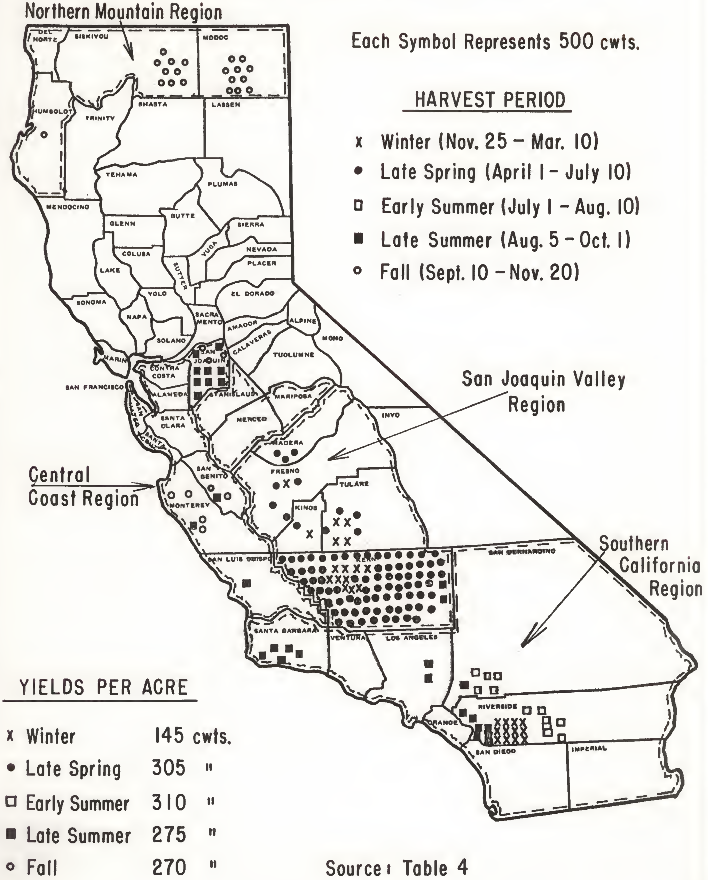
Acreage of Potatoes Harvested in California: 1958-1959 Season

Region & county	Harvesting period					Totals	Percent of state total
	Winter Nov.-Mar.	Late spring Apr.-July	Early summer July-Aug.	Late summer Aug.-Oct.	Fall Sept.-Nov.		
San Joaquin Valley							
Kern	4,900	38,800	--	1,200	--	44,900	46.67
Tulare	2,200	2,100	--	--	--	4,300	4.47
Fresno	500	1,750	--	--	--	2,250	2.34
Madera	150	1,500	--	--	--	1,650	1.71
Kings	300	750	--	--	--	1,050	1.10
Totals	8,050	44,900	--	1,200	--	54,150	56.29
Southern California							
Riverside	6,200	--	6,750	--	--	12,950	13.46
San Bernardino	--	--	2,450	465	--	2,915	3.03
Santa Barbara	--	--	--	2,000	300	2,300	2.40
Los Angeles	--	--	--	800	--	800	0.83
San Diego	--	--	150	--	--	150	0.15
Totals	6,200	--	9,350	3,265	300	19,115	19.87
Central Coastal							
San Joaquin[a]	--	--	--	4,300	1,300	5,600	5.83
Monterey	--	--	--	250	3,800	4,050	4.21
San Benito	--	--	--	300	1,200	1,500	1.56
San Luis Obispo	--	--	--	600	--	600	0.62
San Mateo	--	100	--	--	100	200	0.21
Alameda	--	--	--	--	100	100	0.10
Santa Cruz	--	--	--	--	100	100	0.10
Santa Clara	--	--	--	--	100	100	0.10
Totals	--	100	--	5,450	6,700	12,250	12.73
Northern Mountain							
Modoc	--	--	--	--	5,000	5,000	5.20
Siskiyou	--	--	--	--	4,900	4,900	5.09
Humboldt	--	--	--	--	280	280	0.29
Totals	--	--	--	--	10,180	10,180	10.58
All other counties	50	--	50	85	320	505	0.53
Total for State	14,300	45,000	9,400	10,000	17,500	96,200	100.00
Yield per acre (cwts.)	145	305	310	275	260	270	--
Production (1,000 cwts.)	2,074	13,725	2,914	2,750	4,550	26,013	--
Seasonal production as percent to annual	8.0	52.7	11.2	10.6	17.5	100.0	

[a] San Joaquin has been placed in the Central Coast Region because its harvesting period corresponds with that of this region.

Source: 1960 Yearbook, Potato Growers Association of California and Arizona, Inc., p. 19.

Figure 6. Acreages of Potatoes in 1959, by Season and County.



Each Symbol Represents 500 cwts.

HARVEST PERIOD

- x Winter (Nov. 25 – Mar. 10)
- ● Late Spring (April 1 – July 10)
- ☐ Early Summer (July 1 – Aug. 10)
- ■ Late Summer (Aug. 5 – Oct. 1)
- ○ Fall (Sept. 10 – Nov. 20)

YIELDS PER ACRE

x Winter	145 cwts.
● Late Spring	305 "
☐ Early Summer	310 "
■ Late Summer	275 "
○ Fall	270 "

Source: Table 4

Average yields in the State in 1958-1959 were 270 hundredweights per acre. By seasons, however, there was considerable variation--from 145 hundredweights (winter) to 305 and 310 hundredweights (late spring and early summer).

The four potato producing regions appear closely correlated with the pattern of seasonal production (Table 5). Acreage for the late spring crop is nearly all in the San Joaquin Valley, the early summer crop in the southern California region, and the winter crop in the San Joaquin region plus Riverside County, in southern California. The acreage for the late summer crop is about 87 percent in the southern California and coast regions and 12 percent in the San Joaquin region; and the fall acreage is over 96 percent in the central coast and northern mountain regions.

TABLE 5

Percent of Seasonal Acreage by Regions

Region	Winter	Late spring	Early summer	Late summer	Fall
San Joaquin Valley	56.3	99.8	--	12.0	--
Southern California	43.3	--	99.5	32.7	1.7
Central Coast	--	0.2	--	54.5	38.3
Northern Mountain	--	--	--	--	58.2
Other	0.4	--	0.5	0.8	1.8
	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data in Table 4.

The acreage in different varieties has been changing in recent years in California. Potato specialists in the Department of Vegetable Crops, University of California, estimate that in 1959, the Long White potato accounted for about 70 percent of the state's potato acreage, the Russet

Burbank (grown mainly in the Northern Mountain counties) for about 15 percent, Kennebecs (used mainly for chip potatoes) for 10 percent, and all other varieties for 5 percent.

Dominant factors in considering the economic feasibility of processing potatoes in California are the seasonality and regionality of production and the high percentage of Long Whites. These factors are considered more fully later in this report.

Location of Production in Idaho

Idaho became the foremost potato-producing state in the last few years. The 1959 census showed 200,000 acres in potatoes. All 44 Idaho counties produced some potatoes, but 10 counties had over 75 percent of the total acreage. That area is in the southern portion of the state, along or near the Snake River (Figure 7). Harvest is in late summer in the eight counties in the southwest section (only about 10,000 acres) and in the fall in the rest of the state. The fall potatoes are normally storable for several months. The development of chemical sprout inhibitors in recent years has made a still-longer storage period possible.

It is estimated that over 90 percent of Idaho potatoes are Russet Burbank. This variety has a high specific gravity, or solids content,1/ which makes them more suitable than most other varieties for processing

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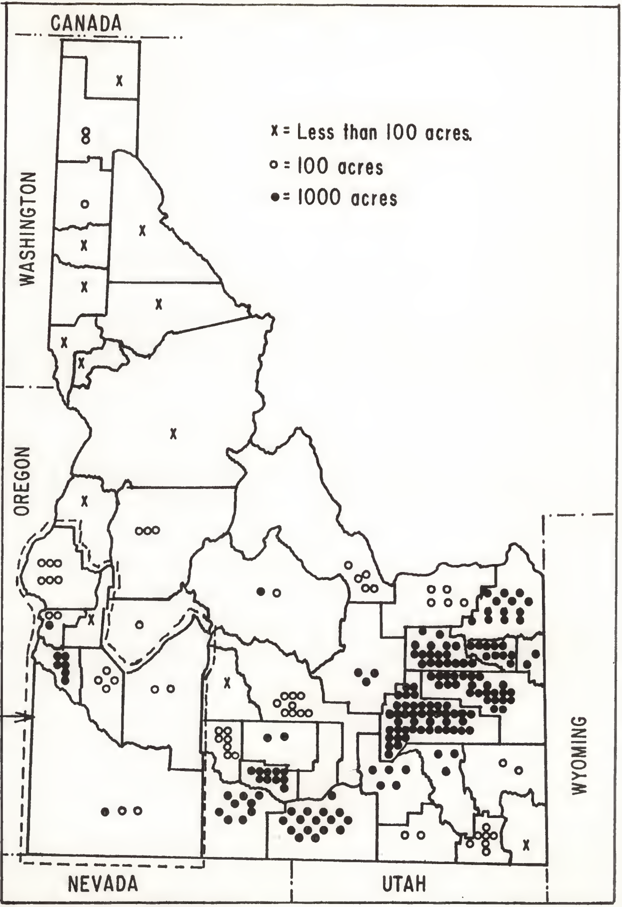
1/ The specific gravity varies by varieties and for the same variety by areas, season of the year, and from year to year. Information obtained from potato specialists indicates a normal range of specific gravity for Russet Burbank from 1.080 to 1.095. In contrast the normal range for Long Whites is from 1.065 to 1.085.

Figure 7. Acreage of Potatoes in Idaho, 1959



Source of Data: 1959 Census

into a variety of dehydrated or frozen potato products. Further, the higher solids content results in greater yield of processed product per hundredweight. Dehydration costs are also said to be less, because of lower moisture content.

Carlot Shipments: California and Idaho

A comparison of monthly shipments of potatoes from California and Idaho indicates the high seasonal concentration in output in California. In 1955-1959 California and Idaho each shipped 45,000 to 59,000 carlots annually (Table 6). The biggest spread was in 1955, when California shipped 59,000 carlots and Idaho only 46,000. The two states were about equal in two years: 1956, just over 50,000 carlots; 1959, just under 50,000. In the first three years of 1955-1959, California shipments exceeded those from Idaho; in the last two years the situation was reversed. Monthly and seasonal patterns of shipments, however, reveal very great variations between the two states.

The pattern of carlot shipments of potatoes in 1955-1959 from California is revealed in monthly percentages of total shipments. June, the month of peak shipments, varied from a low of 28 percent, in 1958, to a high of 38 percent, in 1955, and averaged about 33 percent (Table 7 and Figure 8). May, June, and July ranged from 64 percent in 1958 to 73 percent in 1955, and averaged about 70 percent. April and August combined averaged 10 percent. Thus, about 80 percent of all shipments were in the five-month period April to August, leaving only about 20 percent for the remaining seven months. No month had less than 2 percent.

TABLE 6

Carlot Shipments of Potatoes from Idaho and California, 1955-1959

Year and States	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1955													
Idaho	6,160	4,840	5,810	5,299	2,005	181	85	1,352	1,867	4,772	6,614	6,852	45,837
California	1,814	1,435	1,210	1,039	8,831	22,581	10,242	4,703	2,522	1,262	1,501	1,584	58,724
1956													
Idaho	6,575	6,609	8,411	6,119	1,998	14	930	1,800	2,467	5,068	5,773	5,149	50,913
California	1,442	1,361	1,169	1,545	12,604	18,355	7,828	2,760	1,674	1,183	1,579	1,570	53,070
1957													
Idaho	6,006	5,481	6,346	5,686	3,090	337	436	1,850	2,786	6,227	6,368	6,666	51,279
California	1,610	1,459	1,668	2,310	11,339	18,750	10,615	3,491	1,399	1,460	1,655	1,835	57,591
1958													
Idaho	7,486	7,072	7,216	5,561	4,764	860	693	1,664	3,345	5,793	5,926	6,425	56,805
California	2,111	1,609	1,914	2,800	8,911	14,016	9,196	2,697	1,959	1,554	1,683	1,656	50,106
1959													
Idaho	7,096	5,939	6,963	6,355	2,654	177	293	1,182	2,258	5,037	5,564	5,855	49,373
California	1,735	1,171	1,098	3,127	9,944	14,682	9,255	2,213	1,031	1,134	1,560	1,936	48,886

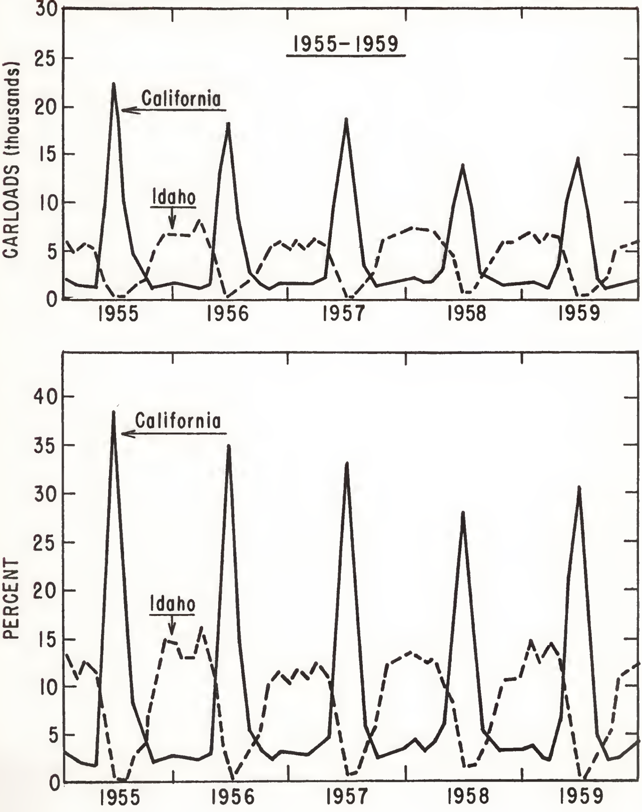
Data taken from "Fresh Fruit and Vegetable Shipments," U.S. Department of Agriculture, Agricultural Marketing Service.

TABLE 7

Percent of Carlot Shipments Each Month from Idaho and California, 1955-1959

Year and States	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1955													
Idaho	13.44	10.56	12.68	11.56	4.37	.39	.18	2.95	4.07	10.41	14.43	14.95	100.00
California	3.09	2.44	2.06	1.77	15.04	38.45	17.44	8.01	4.29	2.15	2.56	2.70	100.00
						70.93							
1956													
Idaho	12.91	12.98	16.52	12.02	3.92	.03	1.83	3.54	4.84	9.95	11.34	10.11	100.00
California	2.72	2.56	2.20	2.91	23.75	34.59	14.75	5.20	3.15	2.23	2.98	2.96	100.00
						73.09							
1957													
Idaho	11.71	10.69	12.38	11.09	6.02	.66	.85	3.61	5.43	12.14	12.42	13.00	100.00
California	2.80	2.53	2.90	4.01	19.69	32.56	18.43	6.06	2.43	2.54	2.87	3.19	100.00
						70.68							
1958													
Idaho	13.18	12.45	12.70	9.79	8.39	1.51	1.22	2.93	5.89	10.20	10.43	11.31	100.00
California	4.21	3.21	3.82	5.59	17.78	27.97	18.35	5.38	3.91	3.10	3.36	3.30	100.00
						64.10							
1959													
Idaho	14.37	12.03	14.10	12.87	5.38	.36	.59	2.39	4.57	10.20	11.27	11.86	100.00
California	3.55	2.40	2.25	6.40	20.34	30.03	18.93	4.53	2.11	2.32	3.19	3.96	100.00
						69.30							

Figure 8. Carlot Shipments of Potatoes from Idaho and California.



In Idaho, in contrast, each month from October to April (seven months) accounted for 10 to 16 percent of annual shipments. May and September were 4 to 7 percent, and August 2 to 4 percent. June and July (the months of heaviest shipments from California) were below 3 percent, actually being less than 1 percent in two years (1955 and 1959).

These differences between the two states are, naturally, related to the seasons when most of potatoes are harvested.

In California, potatoes harvested in the fall or winter are usually placed in underground storage facilities on the farm or left in the ground until required for marketing. This covers only about 25 percent of annual output. The remaining 75 percent, predominantly Long Whites produced mainly in the hot interior valleys, is usually shipped to market within a few hours of harvest. There are two main reasons for this practice. First, in each potato growing area there is a short critical period when potatoes have to be harvested to prevent quality deterioration. Second, growers and shippers aim at taking advantage of the favorable market situation for fresh potatoes during the late spring and early summer.

Informed sources indicate that Long White potatoes can be stored. Because of high temperatures prevailing in the central valleys, refrigeration may be required if the delicate structure of the Long White potato is to be protected in storage for several months. Likewise, low-temperature storage would be necessary if potatoes are to be stored so as to even out the flow into processing and to lengthen the period during which processing facilities can be used each year.

Concentration of over 60 percent of annual output in five months poses a real problem from a processing standpoint. If processing capacity is to

be geared to this period, plants will operate well below capacity in the remaining seven months. On the other hand, if processing capacity is geared to supplies available in the other seven months, it will be inadequate to handle the large proportion of the potatoes available, especially in the late spring season. The processing season could be extended, of course, if potatoes produced in late spring could be extended. Refrigerated storage warehouses would necessitate heavy capital expenditures for buildings and equipment.

Potato Production Costs: California and Idaho

The ability of processing firms in different areas to compete in price will depend to a considerable degree on the prices paid to producers of the raw products.1/

Because of annual fluctuations in supply and demand for such raw products, the average price in any one year may have little relation to the production costs of most producers in a particular area. Over the years, however, the average price level must approximate long-term production costs or output will decline. In addition, processors must pay producers a price that provides, grade for grade, the returns producers can realize on the fresh market.

Persons familiar with the potato industries in the two states assert that potato processing firms in California have to pay much higher prices for potatoes than the prices paid producers in Idaho. Current costs of

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1/ Other factors would be the quality of the raw product available in different areas, seasonality of production of the raw products, and variations in processing costs and conditions in these areas.

producing potatoes are claimed to be at least 50 percent higher in California than in Idaho. Further, the claim is made that reducing California prices to be more competitive with Idaho prices would probably cause California potato production to decline drastically undermining long-term availability for processing.

Comparison was therefore made of approximate production costs for potatoes in Idaho, where potato processing is well established, with costs in California, where there is as yet no processing of frozen and dehydrated products. Such interstate comparisons are hazardous because of differences in computational practices and methods of presentation and because of differences in production and harvesting practices.

For comparison we draw upon: (1) a recent study (1959) made by the University of Idaho of potato production costs in Southeastern Idaho, and (2) a recent sample computation of potato production costs (1960) in Kern County.1/ Both computations reflect costs on farms that were either typical or better than average, but there were several important differences in methods of presenting costs and the nature of the operations included in the cost computations.

The Idaho study grouped costs per acre according to inputs of various factors (materials, labor, machinery, etc.), whereas the Kern County study grouped by operations (cultural, harvesting, and capital). The Idaho

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1/ The costs in Kern County would be fairly typical for other counties in the southern part of the San Joaquin Valley which account for over 50 percent of all potatoes produced annually in California. The Kern County cost computation showed a cost of $2.06 per hundredweight with a yield of 300 hundredweights per acre as compared with $2.40 per hundredweight in western Riverside County with a yield of 220 hundredweights per acre. In the Salinas Valley area the cost of producing "chipping" potatoes was $1.76 with a yield of 330 hundredweights per acre, and in the Tulelake area (1957) the cost of producing Russet Burbank was $2.40 with a yield of 220 hundredweights per acre.

study included only on-farm costs up to harvesting and on-farm storage; the Kern County study included cost of transport to packing sheds and shed costs for grading, washing, and sacks. The Idaho study included no interest on investment; the Kern County study did. The Idaho study was based upon a survey of 68 better-managed farms, the Kern County study was based on a typical farming operation. Because of lack of familiarity of the manner in which indirect costs were allocated to the various input categories it was decided to make approximate adjustments in the Kern County figures so that both studies would reflect costs per acre up to and including harvesting.

The cost computations for Idaho are shown in Table 8, and the original and adjusted computations for Kern County in Table 9. The Idaho study shows costs by four different farm-size groups. These costs, based on a yield of 200 hundredweights per.acre, range from $.98 for the largest group to $1.20 for the smallest group. The unadjusted sample costs for Kern County show a cost of $2.06 per hundredweight based on a yield of 300 hundredweight per acre. After elimination of interest costs on capital and costs of transportation from farm to packing shed and shed costs, the adjusted computation shows a production and harvesting cost of $1.18 per hundredweight.

Considering the differences in land values and yields per acre in Kern County and Idaho, the authors estimate that the inclusion of a 5 percent return on capital in the cost calculations shown in Tables 8 and 9 would give Idaho producers an additional cost advantage of 10 cents per hundredweight. This fact, combined with the lower yield of processed products made from Long White potatoes, would give processors in Idaho a very significant raw material cost advantage over processors in Kern County.

TABLE 8

Potato Production Costs by Size of Farm, Southeastern Idaho, 1959

Cost item	Farm size (costs on a per acre basis)			
	60-100 acres	121-200 acres	201-280 acres	281-400 acres
Materials (Seed, fertilizer, chemicals, bags, etc.)	$ 74.90	$ 74.90	$ 74.90	$ 74.90
Labor (other than operator)	39.70	31.45	29.00	31.60
Machinery (other than fuel and lubricants)	41.35	42.05	37.60	27.95
Buildings (used exclusively for potatoes)	6.25	4.75	4.50	2.35
Trucks and Vehicles (other than fuel and lubricants)	8.10	11.60	8.05	5.25
Fuels and lubricants	21.60	20.70	21.25	24.65
General Overhead ((exclusive of family living or housing)	48.25	38.45	35.00	29.65
Total costs per acre	$240.15	$223.90	$210.30	$196.35
Cost per cwt.--yield of 200 cwts. per acre	$ 1.20	$ 1.12	$ 1.05	$ .98

Source: Weber, Jack and Elwood Jones, "Analysis of Production Costs on Potato Farms in Southeastern Idaho," University of Idaho Agr. Expt. Sta. Prog. Rept. No. 33, November 1959, Mimeo, 17 p.

TABLE 9

Sample Costs per Acre to Produce Potatoes in Kern County, 1960

Operational and other costs	Kern County Early Potatoes: 1960		Nature of adjustment
	sample costs	adjusted costs	
Pre-harvest			
Land preparation	$ 11.10	$ 11.10	
Cut and dip seed	10.50	10.50	
Plant and fertilize	68.70	68.70	
Haul seed and fertilizer	32.92	32.92	
Shape beds and cultivate	1.15	1.15	
Weeding	3.00	3.00	
Irrigation	48.95	48.95	
Pest control	18.00	18.00	
County taxes	12.50	12.50	
Miscellaneous	44.50	44.50	
Total pre-harvest	251.32	251.32	
Investment costs			
Depreciation	28.54	28.54	Exclusion of interest cost
Interest on capital	59.04	--	
Total investment costs	87.58	28.54	
Total pre-harvest investment	338.90	279.86	
Harvest costs			
Vine removal (contract)	3.50	3.50)	Adjustment to exclude costs of transportation and shed costs.
Digging (contract)	12.00	12.00)	
Picking (contract)	48.00	48.00)	
Hauling (contract)	33.00	10.00)	
Shed costs (including sacks)	182.50	--	
Total harvest costs	279.00	73.50	
Total all costs	$617.90	$353.36	
Cost per cwt.--yield 300 cwts. per acre	$ 2.06	$ 1.18	

Source: Irish Potatoes--Costs of Production, Suggestions on Growing, Bakersfield, Kern County, University of California Agr. Ext. Serv. Mimeo, revised March 1960, 5 p.

It is probable, however, that production costs in Kern County could be reduced by substituting mechanical lifting of potatoes for hand picking. Because of the greater fragility of Long Whites and the tendency for clodding of soils at time of harvesting, it has not been economically feasible up to now to use machines for lifting potatoes. It is understood that recent experiments in the southern San Joaquin Valley have shown that a surface irrigation a few days before digging potatoes reduces the clodding problem greatly. Even though there will be additional expense for pre-harvest irrigation this might be more than offset by reduced harvest costs. Minor skin or bruise damage, moreover, might not be so serious if potatoes were destined for processing and not for fresh shipment. Potatoes would be delivered to processing plants in bulk.

THE MARKET FOR PROCESSED POTATOES

This part of the analysis is concerned with the potential market for dehydrated and frozen potato products and the probable impact on fresh sales.

The potato processing industry's experience in developing a consumer market for dehydrated and frozen potato products is generally less than five years. Within this brief period, processing methods have been undergoing constant changes in order to improve both the quality and form of the manufactured products. Meanwhile, the volume of processed potatoes has risen rapidly. This has apparently affected the total demand for fresh potatoes in such major late-crop areas as Idaho and Maine, where a high percentage of the total crop is being sold to processors. There is also reason to believe that competition from processed potatoes may be causing consumer demand to slacken for fresh potatoes from early-and-intermediate-crop areas.

It is within such a changing environment that growers, processors, and distributors must develop their production and marketing plans. Therefore, our attention is focused on a few relevant marketing problems confronting those groups. Something may be learned of the future of both fresh and processed potatoes from available statistics on production and sales of dehydrated and frozen potato products and the experiences of similar food processing industries that have recently been developing markets for new products.

Consumption of Potatoes, Other Vegetables, and Fruits

Potato consumption per person has been declining in the United States since 1910. Then it was about 170 pounds annually. That figure dropped to 123 pounds by 1940, rose to 136 in 1944 (World War II) and again declined, with minor year-to-year see-sawing to a low of 99 pounds in 1956. The figures for 1957, 1958, and 1959 were respectively, 106, 101, and 103 pounds.[1] Figure 9, shows consumption for 1940 through 1959.

This decline is not encouraging to potato growers or processors if viewed solely as a change in dietary patterns--a shift from cereal products and potatoes to animal products, or a decline in consumption per person of all food. A number of authoritative studies show a shift from cereals and potatoes as a nation's population becomes more prosperous and more able to produce animal products, fruits, and vegetables.[2] A recent Ohio State University study states that, "In 1910 potatoes accounted for about 11 percent of the total weight of all food consumed in the United States. Today potatoes make up only 6 percent of the total. Potatoes supply, on the average, only about half as large a percentage of our nutrient requirements today as they did in 1910."[3] Even so, because of the low cost per serving,

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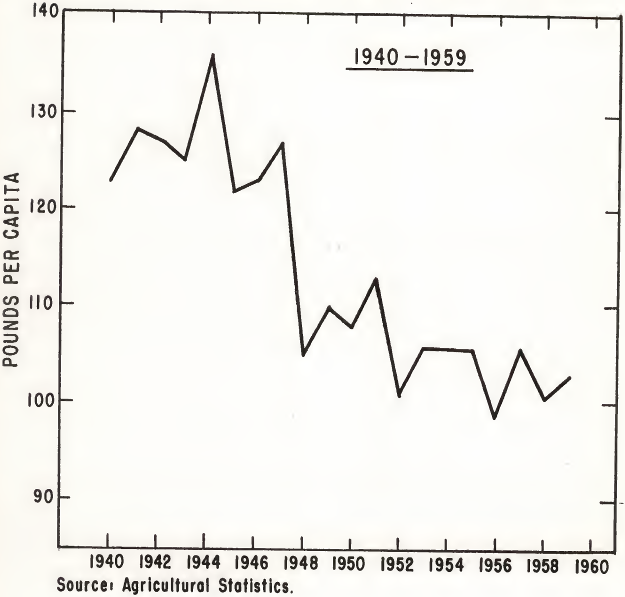
[1] United States Department of Agriculture, Agricultural Outlook Charts '60, Washington, 1959, p. 73.

[2] M. K. Bennett of Stanford University expresses this idea as a "cereal-potato ratio," which shows that the percentage of the caloric content of the diet declines as a nation and its people move from a condition of poverty to a more prosperous level. See the Wheat Studies of the Food Research Institute, Vols. XII and XVIII, 1936 and 1941.

[3] Bere, R. L. and M. E. Cravens, Trends in the Potato Industry with Emphasis on Ohio, 1909 to 1956, Wooster, Ohio Agr.Expt. Sta. Bul. 811, 1958, p. 27. The National Potato Council estimates 7 percent rather than 6 percent of today's total consumption. The Council data includes canned and frozen potatoes.

Figure 9. Potatoes: Consumption per Capita, United States.



Source: Agricultural Statistics.

public eating places and institutional users are believed to have maintained a high level of use of potatoes. This is indicated by Lifquist in her study of the buying practices of manufacturing plants serving food to employees. She writes: "About a fourth of the money spent for vegetables went for potatoes."[1/]

The authors are inclined to the view that the decline in potato consumption in households is due in considerable part to convenient substitute foods that reduce work in food preparation. This premise is supported by the meager statistical data on processing and sales, and the reports of the U.S. Department of Agriculture and private agencies on consumer acceptance and repeat purchases of various processed potato products. In such case, potato processors who produce new high-quality convenience products appear to hold the key to maintaining and possibly increasing the level of consumption of potatoes. This is discussed in more detail later.

Presently, 108 pounds of fruit (including citrus) in processed form are consumed per person annually, compared with 92 pounds in fresh form. Vegetable consumption is 98 pounds processed and 102 pounds fresh. Potato consumption is 20 pounds processed and 80 pounds fresh.[2/] The low proportion of consumption of processed potatoes might be associated with a lag in the ability of the industry to market products wholly acceptable to consumers, product cost, a shortage of suitable refrigeration facilities for storing and distribution at wholesale and retail levels, and/or the short time consumers have had to become acquainted with the new products.

[1/] Lifquist, Rosalind C., Buying Practices and Food Use of Employee Food Services in Manufacturing Plants, Washington, U.S. Department of Agriculture, Marketing Res. Rept. No. 326, 1959, p. 15.

[2/] Grieg, W. S., Futures in Processed Potatoes. Talk given before the Instant Mashed Potato Company "open house" audience, Posen, Michigan, May 2, 1960, mimeographed.

Statistics on the production of processed potatoes give the best indication of their sales and consumption. For example, the National Potato Council estimates that potato chips accounted for about 76 percent of all processed potatoes sold in 1951 and 53 percent in 1959, and it projects 48 percent for 1960. Dehydrated and frozen French-fried potatoes accounted for about 15 percent of the total processed product in 1951, and an estimated 45 percent in 1960. Various industry forecasts for 1970 range from 50 to 85 percent. Since early-crop potatoes are not well adapted to processing (see previous discussion), 85 percent appears very optimistic; the 50 percent estimate appears feasible before 1970.

Table 10 shows the changes in processed potato production for 1955 through 1959, and projections for 1960 and 1961. Table 11 gives the production and utilization statistics for the crop years 1940, 1951, 1959, and 1960.

Factors Favoring Increased Consumption

Before potato flakes were placed on the market, a U. S. Department of Agriculture study disclosed a positive consumer response indicating a good market potential.1/ Later surveys by Michigan State University and private research agencies showed a favorable consumer and institution response to dehydrated mashed potatoes,2/ and recent industry reports indicate an inability to keep up with orders for the processed products, which seems to confirm the survey findings.

1/ Dowskin, Philip B. and Milton Jacobs, Potato Flakes--Market Position and Consumer Acceptance, Washington, U.S. Department of Agriculture, Marketing Res. Rept. No. 186, 1957.

2/ Grieg, W. S., The Restaurant, Hotel, and Institutional Market for Dehydrated Mashed Potatoes, East Lansing, Michigan State University, A.E. 691, September 1957.

TABLE 10

Production of Processed Potato Products

Product	Crop year						
	1955	1956	1957	1958	1959	1960[a]	1961[a]
	million pounds of finished product						
Au gratin, cubes, patties scalloped, shreds, sliced, etc.	20	14	22	20	30	40	75
Instant mashed							
Granules	15	20	40	50	70	80	100
Flakes	--	--	--	20	31	40	60
Frozen prepared products	175	250	225	330	400	530	700
Potato chips	590	670	670	700	730	760	800
Total	800	954	957	1,120	1,261	1,450	1,735

a/ Estimate

Source: National Potato Council.

TABLE 11

Volume of Potatoes Processed in United States

Type of product	1940	1949	1959
	1,000 cwt.		
Flour	240	688	2,220
Dehydration	--	349	12,000
Canning	--	498	1,020
Hash, stews, and soups	300	900	1,500
Frozen French fries	--	540	9,000
Potato chips	2,700	12,060	28,200
Totals	3,240	15,035	53,940

Source: National Potato Council.

It appears that the consumption of dehydrated potatoes in public eating places may be exceeding expectations. Based on his Michigan study of restaurants, hotels, and institutional-type eating places Grieg concluded that there was an immediate (1957) market for dehydrated potatoes in such eating places, equal to 22 percent of the total quantity of potatoes used, and a potential market for 33 percent of the total quantity used.1/ In 1960, he reported that "over 50 percent of the potatoes used by public eating places in mashed form in Detroit were from dehydrated mashed potatoes."2/

A primary consideration in the marketability of a food is consumer taste. Newer processing methods appear to have met consumer preferences in this respect. Taste preferences were not met, however, until the late 1950's, after which sales picked up measurably.

A second factor in marketability is price and consumer disposable income. The relatively high level of disposable incomes has undoubtedly worked in favor of the sale of all convenience foods, including processed potatoes, as indicated by many studies during the past 5 years. The most tangible evidence of price as a factor in the sale of potatoes is that the processing industry has not expanded fast enough to keep up with current orders. A second bit of tangible information about price-demand responses came out of a test conducted in 1959 by the Michigan Potato Industry Council. It showed a high demand elasticity--a 10 percent sales increase from a 10 percent reduction in price, and a 70 percent sales increase from a 30 percent reduction in price. If this test is confirmed, pricing may be an exceptionally important factor in the shift to processed potatoes.

1/ Op. cit., p. 42.

2/ Op. cit., p. 42.

A third factor favoring the sale of processed potatoes is consumer convenience. The manner of living of people in urban areas reduces storage space in the home to a minimum and encourages hand-to-mouth buying. For homemakers, processed potatoes are a labor-saving item of some importance. For public eating places, where hired labor must be used to prepare fresh potatoes for cooking, labor costs may have caused a rapid shift to pre-prepared, dehydrated, and frozen fruits and vegetables, including potato products. For all types of consumers, elimination of shrinkage and spoilage is a major consideration, particularly as the unit price of the product increases.

Since there is an inadequate basis for an objective decision on future prospects for processed potatoes, let us examine briefly what is taking place generally in the food industry.

The willingness of consumers to try new food products has stimulated potato processors to expand their operations. The Campbell Soup Company claims that, "Of the 91 products now being offered (1959) ..., over two-thirds are new since 1945 ... and Campbell's sales have more than tripled in that period."1/ According to Charles Mortimer, president of General Foods, an integrated food manufacturing firm involved in potato dehydrating and freezing, the company "is investing more facilities, more manpower, more funds, and more concentrated attention on new and improved products than ever before."2/ In addition, Paul Willis, President of the Grocery Manufacturers of America, stated that "about two-thirds of today's grocery sales are in products new or basically improved since 1946."3/

1/ This Week Magazine, 8th Biennial Grocery Study, New York, July 1959, p. 29.

2/ Ibid., p. 30

3/ Ibid., p. 29.

In any list of new products, convenience items are becoming increasingly important. The sales of 10 new products in 1957, compiled by the Market Research Corporation of America (Table 12), give an idea of the magnitude of the sales of convenience items.

TABLE 12

Sales of Typical New Products in 1957

Category	Dollar sales
	million
Baking mixes	290
Chilled fruit juices	45
Detergents	675
Dry milk	75
Frosting mixes	17
Frozen fruit and dessert pies	37
Frozen juice concentrates	350
Frozen pre-cooked foods	155
Instant coffee	430
Instant potatoes	15
Margarine	450
New food drinks	88
Refrigerated dough	60
Total	2,687

Source: Market Research Corporation of America, This Week Magazine, Food Topics.

Chain Store Age, July 1959, published a list of product group sales as a percentage of total chain store sales in 1958. The list included the following items:

Item	Percent of total chain store sales
Baby foods (prepared)	.9
Baking mixes	1.2
Frozen foods (excluding ice cream)	4.5
Instant coffee	1.1
Potato chips and party snacks	.7

Since chain stores handled about 38 percent of all grocery store sales in 1958, these data are a further indication of the importance of convenience foods.

New Fruit and Vegetable Products

The burden of the preceding section is that consumers are buying more convenience in food products. From the standpoint of processors and distributors this expression of consumer preference creates a demand for more and different kinds of marketing services, all of which divert more of the consumer's food dollar into payment for processing and distributing services. This may be economically sound considering the state of our technology. The question at issue, however, is: What are the effects of new products on total and per person consumption of all fruits and vegetables?

Table 13 shows the yearly changes in the consumption per person of all commercially produced citrus and noncitrus fruits in the United States from 1935 through 1958. Consumption per person of all fruits tended upward between 1935 and 1946, and then declined through 1958. The 11.5 pounds per person drop from 1957 through 1958 was attributed to a short citrus crop. The consumption per person of all fresh fruit gradually declined from a high

TABLE 13

Fruit (fresh-equivalent basis): Consumption per Person
United States, 1935-1958

Year	Dried	Canned	Frozen	Used fresh	Total
	pounds				
1935	19.5	20.9	0.6	136.5	177.5
1936	20.8	23.6	.7	129.1	174.2
1937	20.0	28.5	.5	142.5	191.5
1938	20.5	27.8	1.1	135.3	184.7
1939	21.6	33.0	1.1	151.5	207.2
1940	22.9	37.5	1.2	142.1	203.7
1941	19.4	42.3	1.4	148.9	212.0
1942	14.8	40.7	1.4	131.4	188.3
1943	17.0	31.3	1.2	119.7	169.2
1944	21.7	35.9	2.2	141.7	201.5
1945	22.1	41.4	2.7	142.0	208.2
1946	19.8	67.7	3.9	136.5	227.9
1947	15.3	58.7	3.6	142.3	219.9
1948	14.4	64.8	3.7	131.1	214.0
1949	14.7	56.3	9.3	123.3	203.6
1950	14.6	52.8	13.7	107.4	188.5
1951	13.8	51.5	17.9	115.5	198.7
1952	13.4	50.0	24.7	112.5	200.7
1953	13.3	50.1	27.5	111.3	202.2
1954	13.4	49.0	30.2	106.1	198.7
1955	13.4	51.9	34.8	101.6	201.7
1956	12.6	51.8	34.5	100.4	199.3
1957	12.1	52.4	36.8	99.3	200.6
1958	11.3	53.5	29.6	97.8	192.1
1959[a]	10.7	49.9	36.1	101.5	198.2

[a] Preliminary.

Source: Data published in the Fruit Situation, Agr. Marketing Serv., U.S. Department of Agriculture.

of 151.5 pounds in 1939 to 97.7 pounds in 1958. In the same period, frozen fruit sales rose from 1.1 pounds to 29.7 pounds per person. Canned-fruit consumption rose from 33.0 pounds in 1939 to 67.7 pounds in 1946, and gradually declined to 50.3 pounds in 1958. Consumption of dried fruits has been declining since 1939, from 21.6 pounds to a low of 11.4 pounds in 1958.[1/]

Table 14 shows changes in consumption per person of all commercially produced vegetables from 1935 through 1958. Here again the trend is significant. Consumption moved upward from 1935 through 1946, and gradually declined through 1958. Consumption of fresh vegetables declined, and canned and frozen products rose. As percentages of the annual total consumption per person, fresh, canned, and frozen vegetables were respectively 65, 34.2, and .8 percent in 1940. For 1958 the percentages were 50.8, 41.5, and 7.7 percent.

The foregoing statistics reflect a rational trend for all fruits and vegetables, considering the greater availability of a wider choice of food products, and a growing tendency of persons to reduce total food intake because of a more sedentary manner of living. But does it apply to potatoes?

Processed Versus Fresh Sales

The decline in potato consumption from 170 pounds per person in 1910 to slightly below 103 pounds in 1956-1959 must be considered in planning potato production, processing, and marketing activities. There is no reasonable certainty that total and per person consumption will not decline

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[1/] Op. cit., p. 1.

TABLE 14

Commercially Produced Vegetables, Civilian Per Person Consumption United States, 1937-1959

Year	Total, fresh and processed	Fresh[a]	Fresh equivalent processed[b]			As percentage of annual total			
			Total	Canned	Frozen	Fresh	Processed		
							Total	Canned	Frozen
	pounds					percent			
1937	164.3	111.0	53.3	52.3	1.0	67.6	32.4	31.8	0.6
1938	170.1	114.5	55.6	54.6	1.0	67.3	32.7	32.1	.6
1939	174.6	116.5	58.0	56.8	1.2	66.8	33.2	32.5	.7
1940	179.9	116.9	63.0	61.6	1.4	65.0	35.0	34.2	0.8
1941	180.5	113.5	67.0	65.4	1.6	62.9	37.1	36.2	.9
1942	192.7	118.3	74.4	71.8	2.6	61.4	38.6	37.3	1.3
1943	186.6	116.4	70.2	68.5	1.7	62.4	37.6	36.7	.9
1944	195.2	123.5	71.7	67.9	3.8	63.3	36.7	34.8	1.9
1945	221.6	133.8	87.8	83.4	4.4	60.4	39.6	37.6	2.0
1946	223.8	129.9	93.9	89.2	4.7	58.0	42.0	39.9	2.1
1947	206.0	122.4	83.6	77.5	6.1	59.4	40.6	37.6	3.0
1948	199.5	123.0	76.5	69.5	7.0	61.7	38.3	34.8	3.5
1949	193.3	115.8	77.5	70.7	6.8	59.9	40.1	36.6	3.5
1950	198.8	114.6	84.2	76.8	7.4	57.6	42.4	38.7	3.7
1951	200.6	111.6	89.0	79.7	9.3	55.6	44.4	39.8	4.6
1952	199.2	111.0	88.2	76.9	11.3	55.7	44.3	38.6	5.7
1953	199.7	108.3	91.4	79.6	11.8	54.2	45.8	39.9	5.9
1954	196.6	107.3	89.3	76.8	12.5	54.6	45.4	39.1	6.3
1955	198.6	104.6	94.0	80.5	13.5	52.7	47.3	40.5	6.8
1956	202.5	106.9	95.6	81.5	14.1	52.8	47.2	40.2	7.0
1957	200.5	104.6	95.9	81.4	14.5	52.2	47.8	40.6	7.2
1958	200.3	102.1	98.2	82.8	15.4	51.0	49.0	41.3	7.7
1959[c]	198.0	99.6	98.4	82.7	15.7	50.3	49.7	41.8	7.9

[a] Excluding melons.

[b] Data include pickles and sauerkraut in bulk; exclude canned and frozen potatoes, canned sweet potatoes, canned baby foods, and canned soups.

[c] Preliminary.

Source: Data published in the Vegetable Situation, U. S. Department of Agriculture, Agricultural Marketing Service.

further. The introduction of processed potatoes, however, and their promotion by national and regional food manufacturers, may help reverse the trend and stabilize consumption per person somewhat above the level of the last four years. If so, the effect on total potato consumption would be substantial, considering an annual population growth of about 2 percent each year.

Processed potato sales might follow along this pattern:

1. The maintenance of a high level of consumption of potatoes in public and institutional eating places is associated with the cost of serving potatoes compared to other food items.1/ The most common method of preparation is mashed. It is doubtful, therefore, that the level of mashed potato consumption in such eating places will be increased by purchase of the dehydrated product, assuming that the price relationships between potatoes and other food items is not altered greatly.
2. There is a reasonable possibility of increasing the use of frozen French fries as public eating places and institutions acquire necessary refrigeration facilities and regularly offer them. There is presently some doubt that freezing facilities in such eating places are adequate to handle any substantial increase in frozen food products. There is a reasonable basis to believe that, with proper facilities, the sale of frozen French fries to such eating places might more than offset any decrease in the consumption of fresh mashed and baked potatoes.

1/ A. E. Mercker of the National Potato Council stated in a letter to the authors that "restaurants, hotels, etc. have detailed charts showing the cost per serving of each product. The raw material cost for mashed potatoes is about 1-1/4 cents ... including heat and everything else. I doubt if the cost goes up beyond 2 cents to 2-1/4 cents ... with frozen French fries, the cost would be about 5 cents or 6 cents."

3. The household market for both dehydrated and frozen potato products appears promising for the immediate future and in the long-run, even though consumption per person may not increase. Dietary considerations loom large in the minds of homemakers, but convenience is also of real importance as women spend more time outside the home and family income can pay for preparation and even some precooking of food outside the home. Moreover, home refrigeration facilities are becoming more common, making it practical for homemakers to buy frozen products for later use. The adaptability of dehydrated and frozen potatoes to modern living conditions is regarded as extremely favorable.

Supply Stabilization

The seasonal price gyrations in the fresh potato market grew out of market gluts and shortages. Thus, the greater storability of processed potatoes, particularly in late spring, might level out supply problems and at least reduce the price premium often paid for fresh early-crop potatoes.

The probable effects of using dehydrated and frozen potato products for supply equalization should be weighed carefully by growers in the early-and-intermediate-crop states. The higher prices for early than for late potatoes has enabled relatively high-unit-cost producers, as in the San Joaquin Valley, to prosper since 1940. If, as expected, more processed potato products are available in the 1960-1961 season, and if active sales promotion acquaints more consumers with the new products, the demand for fresh potatoes could be affected in the spring of 1961. Conversely, there is a reasonable possibility that enough of the 1960 late crop will be diverted to processing channels to strengthen demand for such potatoes throughout the winter of 1960-1961.

The foregoing analysis indicates a very favorable consumer acceptance of potato flakes and granules, the major processed items. Potato chips have grown in favor over the years. It also appears that frozen potato products--French fries, salads, etc.--are being well received. Such acceptance is basic to further planning in the entire potato processing industry, and it is particularly important to California growers.

We now consider the feasibility of establishing a potato processing industry in California.

POTATO PROCESSING IN IDAHO

The preceding section showed a several-fold increase in processed potato products in the United States during the last decade, and that further increases are in prospect during the next ten years.

The processing of potato chips is widely dispersed all over the United States--close to points of ultimate consumption. Processing of dehydrated and frozen potato products, however, is concentrated in a relatively few states, Idaho being by far the most important. One source estimates that about 70 percent of the total United States supply of dehydrated and frozen potato products is processed in Idaho. The following statement indicates the importance of potato processing in Idaho:

> "The potato grown in Idaho lends itself better than any other to certain processing methods. Idaho growers raise only about one-sixth of the nation's potatoes, but one-third of the amount processed in the United States last year was done in Idaho. Chips and shoe-strings are manufactured in the metropolitan areas where they are consumed--production of these products in Idaho is almost negligible. However, about 70 percent of the nation's total dehydrated and frozen potato products are processed in Idaho. The altitude and volcanic ash in the soil are said to give the Idaho potato the characteristics which suit it so well to freezing and dehydration." 1/

Utilization of the 1959 Crop

Information from the Agricultural Extension Service in Idaho showed about 12,600,000 hundredweights of potatoes processed into chipped, dehydrated, and frozen potato products in 1959 (Table 15). This was about 32 percent of the total 1959 crop, or 43 percent of the proportion of total crop used for food. Estimates were that 35 to 40 percent of the 1960 crop would be processed, and that within a few years the proportion of an expanded crop would reach 50 percent.

1/ Unpublished confidential report.

TABLE 15

Disposition of 1959 Potato Crop: Idaho

	Cwt.	Percent of prod.	Percent of food uses
Production	40,496	100.0	
Less not used for food or processing	8,684	21.4	
For processing and fresh shipments	31,812	78.6	
Less processed into starch and flour	2,412	6.0	
Available for food purposes	29,400	72.6	100.0
Shipped fresh	16,776	41.4	57.1
Used for processing into food	12,624	31.2	42.9

Source: Idaho Agricultural Extension Service.

Processing Facilities

In 1959 there were 20 firms (totaling 24 plants) engaged in the processing of potatoes[1/] (Table 16): one potato canning plant, seven starch and flour plants, and five potato-chip plants, and eleven plants processing dehydrated and/or frozen potato products. Most of the canning, starch and flour, and potato-chip plants had a volume relatively small compared with that of the dehydration and frozen food plants.

Eight new dehydration and/or frozen-food plants are planned to come into operation in 1960 or 1961. Some are being erected by firms already in potato processing. Nearly all the old, as well as the new plants, are in the southern part of the state, near the Snake River (Figure 10).

[1/] One of these plants is located in Ontario, Oregon, just west of the Snake River.

TABLE 16

Potato Processing Plants in Idaho, 1959, 1960, and 1961

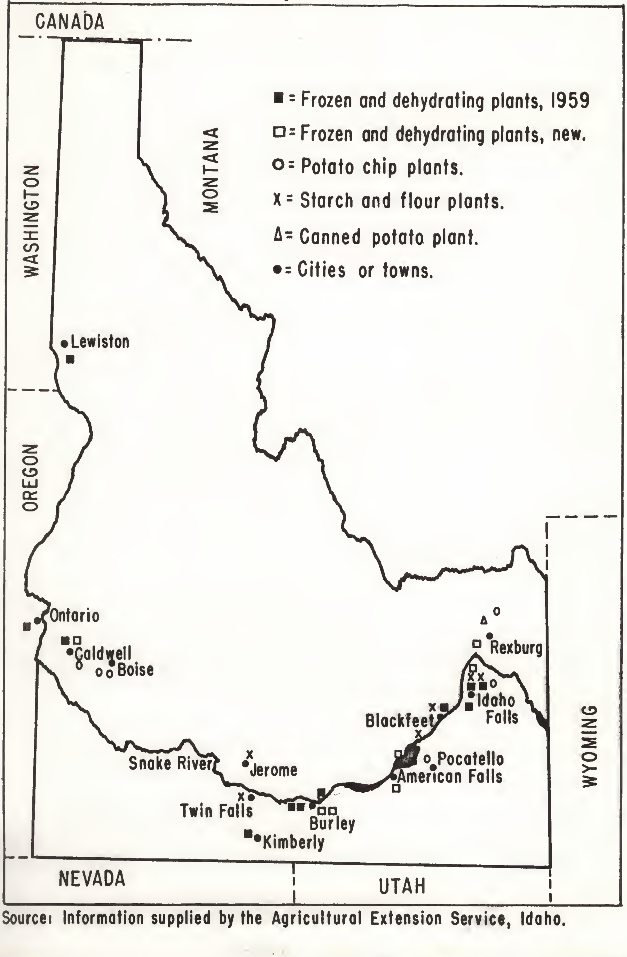
	Firms	Old 1959 plants	New 1960-1961	Total in 1961	
				Firms	Plants
Dehydrated and frozen	9	11	8	14	19
Canned	1	1	-		
Starch and flour	5	7	-		
Chips	5	5	-		

Source: Idaho Agricultural Extension Service.

The scale of operations of processing plants in Idaho can be roughly estimated by dividing the total volume of potatoes processed into food products (other than flour) in 1959 by the number of food processing plants. The average volume of raw products processed per plant in 1959 was 740,000 hundredweights (12,624,000 ÷ 17). This average, however, included the relatively small canning and potato chip plants. Some of the plants processing dehydrated and/or frozen potato products handled over one million hundredweights in 1959.

Officials of the plants visited indicated that more than 30 different types of processed potato products were being manufactured. Greatest volume was in frozen French fries. Some of the firms process only a few products (e.g., dehydrated products); others have highly integrated operations including production of potatoes, fresh shipments, processing of dehydrated and frozen products, and nonfood by-products. All of the larger firms maintain research departments, for quality control, and for developing but also new products and improved processing methods.

Figure 10: Potato Processing Plants in Idaho.



Source: Information supplied by the Agricultural Extension Service, Idaho.

Capital Investments

The officials visited were reluctant to divulge capital invested in plant and equipment and in market development. The amount of capital would, of course, depend on size of operations and the nature of the product or products that are processed. A small plant producing only granule or flaked potatoes or canned potatoes would have a very much smaller investment (possibly only a few hundred thousand dollars) than a large plant (large in terms of volume handled) producing a variety of processed products. Investment in buildings and equipment for production of frozen potato products, which requires considerable cold-storage facilities, would probably exceed $1,500,000. Further light is shed on the question by several informed persons and agencies.

In a paper read before the Eighth Annual Potato Utilization Conference, held at the University of California, Davis, on August 25, 1957, the following statement was made:

> "In view of the above we feel that in order to do a good, sound, competitive job and to insure his continued life in the business, a new manufacturer should figure to spend approximately a million and a half dollars on plant and equipment, including freezing and storage facilities, and that he should have at least a million dollars in working capital to produce and carry his products." 1/

Further evidence on the cost of entering potato processing, particularly of dehydrated products, is afforded by the following:

1/ Baxter, J. L., Jr., "Problems and Developments in the Frozen Potato Industry." This article appeared in the 1958 Yearbook of the Kern County Potato Growers Association, Bakersfield, California, pp. 145-151.

[illegible]

[illegible]

[illegible]

> [illegible]

[illegible]

[illegible]

> "For plants of 100-ton per day capacity the building and equipment costs may range from half a million to a million dollars depending upon the commodity and upon the type of dehydrator used. Total capital and credit requirements are estimated to range from over a million to over two and a half million dollars. It is evident, therefore, that a dehydration plant cannot be built and operated on a 'shoestring.' Unless the prospective dehydrator is prepared to consider an investment of the magnitude mentioned, he should stay out of the fruit or vegetable dehydration business. Obviously there are many ways of reducing the amount of capital required; but unless investment economics are made prudently, the dehydrator may end up with an unprofitable operation." 1/

A rough, but probably ultra-conservative, estimate of investment in potato processing in Idaho may be obtained by assuming an average investment of $1,000,000 per plant for the 16 plants in operation in 1960. At $16,000,000 for plant and facilities and another $16,000,000 for market development, the total would be about $32,000,000. It is not unlikely, however, that the total may exceed $40,000,000, because several of the plants in Idaho are of considerable size.

Operating Practices

Managers of plants processing dehydrated and/or frozen potato products aim at operating nine to ten months a year in order to make most effective use of capital and other resources. They can do this because potatoes can be stored eight months or longer. During a considerable part of the year, facilities are operated for 24 hours a day. If potatoes were available for only a few months in the year (say 3-5 months), they claim, plant capacity and investment would have to be expanded greatly.

1/ Management Handbook (To Aid Emergency Expansion of Dehydration Facilities for Vegetables and Fruit). Prepared by the Western Utilization Research and Development Division, Agr. Res. Serv., U.S. Department of Agriculture, Albany, California, January 1959, p. 23.

> [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Much experimental work is necessary, not only in developing new products but also in designing special equipment. Not infrequently, equipment designed on an experimental basis proves inadequate under volume operating conditions and has to be scrapped or drastically reconstructed. In fact, many firms that have come into existence during the last few years incur very high obsolescence costs, occasionally as high as 70 percent over a three- or four-year period. Potato processing is a comparatively new industry.

Two important factors in processing potatoes are water supplies and waste disposal. Tremendous quantities of water are needed in certain types of potato processing. The production manager of one firm said the plant used more water annually than was used for all purposes in a nearby city of about 12,000 persons. Fortunately, the Snake River provides abundant water at reasonable cost. Waste disposal seems to be no particular problem so far, but several processors thought it might be in the years ahead.

Most firms had difficulty getting enough potatoes from Idaho sources in the beginning of the 1959-1960 operating year (August and September), and again at the end of the year (May).1/ At such times, however, potatoes can be bought from Washington and California. Such out-of-state supplies mean higher raw-product costs, but are justified by extending operations another month or two, and by a need to meet sales commitments.

The 6-8 new plants in 1960-1961, as well as expanded facilities in some of the older plants, will probably increase total capacity more than 50 percent by 1961. Nevertheless, it is probable that competition for

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1/ Plants are usually closed for repairs and structural changes in June and July of each year.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

among processors will be intense for at least two or three years. Thus, a larger proportion of Idaho potatoes will probably be sold in the processing rather than the fresh market.[1/] It is also probable that supplies of potatoes toward the end of each processing season (April-May, and possibly June) may be so low that these new plants, as well as older plants, will have to secure additional supplies from adjacent states, and especially from California, where harvesting reaches a seasonal peak.

In May and early June, 1960, some processing plants in Idaho bought several hundred carlots of potatoes from California, primarily for processing into frozen French fries. The manager of one firm said the potatoes were not very satisfactory. The manager of another firm, however, reported that the first-grade potatoes his firm bought were satisfactory. He considered the purchases economically justified in spite of the higher price paid for first-grade potatoes and the transport costs, because his plant operated several weeks longer. In any case, the potatoes were needed to maintain supplies of frozen French fries to the trade.

There is every indication that processors of potato products in Idaho will draw upon California for some potatoes during the next three to four years, especially during May and June, if the present level of disposable personal income is maintained.

Market Factors

Many of the Idaho firms have been in operation five years or more. Most of them pack and sell their products under both their own brand names

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[1/] There is evidence that such a shift has already taken place. In 1958 production of potatoes in Idaho was 33 percent higher than in 1955, whereas carlot shipments were only 24 percent higher. The comparable figures for 1959 were 22 percent for production and 8 percent for shipments.

and brand names of wholesale buyers. Capitalizing on the national reputation built up for Idaho potatoes over the years, the containers usually identify the finished product as made of Idaho potatoes.

The bulk of the output goes into institutional trade and is sold through food brokers. Diced potatoes go primarily to firms that manufacture hash, stews, and soups. The specialized products, like potato salad, au gratin, etc., are a small proportion of total output, though the potential sales of these products is great. Estimates made early in 1960 indicate that about 71 percent of the frozen and dehydrated (granules, flakes, diced, hash browns, and slices) processed in the 1959-1960 season would go into the institutional trade, and only 29 percent to household users (Table 17). About 80 percent of the frozen products, and 51 percent of the granules and 25 percent of the flakes, hash browns, and slices were packaged in large containers for institutional trade.

TABLE 17

Estimated Distribution of Processed Potatoes: Idaho 1959-1960

Type of product	Total million pounds	For institutional trade		For retail trade	
		Million pounds	Percent of total	Million pounds	Percent of total
Frozen potato products	479	373	79	101	21
Granules	78	40	51	38	49
Flakes, diced, hash browns, and slices	50	12	25	38	75
	607	430	71	177	29

Source: Confidential report.

Frozen products for the institutional trade are usually packed in 5-pound bags, six bags per corrugated case; granules in 5-pound cans, six to the case; flakes in large bags shipped individually, and in smaller bags, six to a case, or in 2-1/4-pound cartons, six to a case. For the retail trade, frozen products are packaged in 10-ounce cartons, 24 to a case; and flakes and granules also in cartons, 24 to a case.

Most processors dispose of their output at very satisfactory prices as long as quality is maintained. Thus, the general impression is that demand has tended to outrun supply.

There is every reason to believe that the processors have earned very satisfactory returns on their investments. With the entry into the industry in Idaho of several new processing firms, one integrated with a national food chain, competition may become more severe for both supplies and trade outlets. The prices for some products might decline unless demand continues to expand more rapidly than supply. Most processing firms are optimistic on this score.

Favorable Factors in Idaho

Several factors have favored the potato processing industry in Idaho. It is likely that the same factors will be equally important in further development in that state and will affect prospective potato processors in California. These are:

1. Idaho is the most important potato producing state.
2. Acreage in potatoes, predominantly Russet Burbank, has expanded rapidly during the last decade, and further expansion is predicted for the next decade.

3. Yields per acre have increase, and further moderate increases are in prospect.
4. The Russet Burbank variety, because of its high specific gravity or solids content, is well adapted to processing into a variety of dehydrated and frozen potato products.
5. The potatoes are mostly harvested in the fall, and therefore can be stored economically on farms or in warehouses without serious deterioration. Sprout inhibitors further extend storage life.
6. Idaho processors are therefore able to operate 9-10 months each year with a fairly uniform daily and monthly inflow of raw product.
7. Prices that processors pay producers have been high enough to bring new acreage into production and to divert potatoes from fresh to processing outlets.
8. Supplies of water for processing are abundant at relatively moderate cost.
9. Most established processors have passed through the costly stage of developing new products and new equipment and of testing consumer response.
10. Established processors have developed relatively firm trade connections and consumer acceptance of their product.

In contrast to the spectacular development in Idaho, California has had only one commercial venture into potato processing--and that was short-lived.

In 1958 a plant was established in Bakersfield, primarily for processing dehydrated potato flakes. Subsidiary operations appear to have been canning small potatoes and packing and shipping fresh potatoes. Information from various industry sources indicates that several hundred thousand dollars were invested in plant and equipment. Even though quality was satisfactory (particularly in flaked potatoes) the plant closed after only about five months. Information indicates that the operator had a number of production problems connected with the labor force, supply and cost of water, and waste disposal. It is not unusual, however, for a new processing firm to encounter similar difficulties, especially if the venture is of a pioneering nature. The main reasons for the failure appear to have been insufficient working capital and difficulty in establishing a market for the processed products.

FINDINGS

The potato industry of California is at the cross-roads. Growers and shippers are faced with two important decisions. The first would be predicated upon the assumption that the early-crop area of California has enough economic advantage in producing for the fresh market to justify a continuous effort to supply consumers who prefer fresh potatoes, even though expansion is considerable in the production and consumption of processed potatoes. With a rapidly expanding population in the west and nationally, acreage may be only slightly reduced. More attention could be given to mechanization and other methods of reducing production costs in order to offset any price-depressing effects of processed potatoes on fresh-market prices. This emerging situation may offer an unusual opportunity to growers and shippers of potatoes to promote a favorable consumer attitude for fresh over processed potatoes.

The second decision would be predicated upon the assumption that substitution by consumers of processed for fresh potatoes will be substantial in the next decade or two. The consumer market for early-crop fresh potatoes may still be substantial, but it is unlikely to absorb the volume it has taken in recent years. If so, and most evidence points in that direction, potato growers and shippers in California will face a major curtailment in acreage or diversion of part of production into processed potato products.

What conclusions can be arrived at regarding the economic feasibility of establishing a potato processing industry in California? The following evaluation is predicated largely upon:

1. Suitability of the long white potato for processing
2. Supply factors: annual volume, seasonal and location distribution
3. Number, location, and size of processing plants
4. Market development, and
5. Capital investments and sources.

Suitability of Long White Potato

The first and probably most important single consideration is whether the basic raw material is suitable for processing into either a single product or range of products.

From all accounts over 70 percent of the total annual output of potatoes is of the Long White or White Rose variety. The potatoes grown in the Northern Mountain counties (Tulelake area) are Russet Burbank, harvested in the fall of the year. Acreage planted to Kennebec is increasing. Most of the acreage in Kennebec is in the southern San Joaquin Valley and the coastal area. Kennebecs are marketed mainly to chip processors, with only a small part of the output normally available for dehydrated and frozen potato products.

The Long White is not regarded as ideal for processing. It has a low specific gravity, giving a lower yield of processed product per ton than do Russet Burbanks. Tests at the Western Regional Research Laboratory, Albany, indicate that the Long White will make a granule product with good reconstitutability and taste. Nevertheless, the low product yield apparently would place a processing firm in California at a disadvantage over firms processing potato flakes in Idaho. A second disadvantage of the California Long Whites is their short storage life unless controlled-temperature storage is available. Such storage would be relatively costly for lengthening the period during which potatoes could be made available for processing.

As far as is known there have been no tests exclusively on the suitability of Long Whites for processing into frozen French fries and other forms of dehydrated and frozen products. During 1960, several hundred carlots of Long Whites from California were processed into frozen French fries in Idaho plants. When first-grade Long Whites were used, the processors were relatively well satisfied with the product obtained.

Supply

At first glance it would appear, from the supply standpoint (volume, location, and seasonal distribution), that California should be able to support a sizable potato processing industry. But that is not the case. The reason is mainly the high concentration of production into a three-month period in the San Joaquin Valley, the most likely area to support a processing industry.

The California potato industry has been developed to a considerable extent to take advantage of a market when national supplies of fresh potatoes from other states are at the lowest. From a national standpoint, almost 70 percent of the annual output is in the fall (August-November). By April or May, supplies of fall-harvested potatoes, plus the relatively small volume of potatoes harvested in the winter and early spring, are just about exhausted and have deteriorated in quality.

Thus, a potato supply for a year-around processing industry does not now exist. Unless ways can be found of lengthening the harvesting or storage period to provide a steady flow of potatoes for eight to ten months each year, an economically sound processing industry may not be possible. The peaking of a supply would have to be offset by other plant efficiencies. Is such feasible?

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Normally about 53 percent of the total output of potatoes in California are harvested in the late spring season (April-July), with another 11 percent in the early summer season (July-August). The supply is largely from the interior valleys. Because of the high temperatures in these valleys, most potatoes are shipped to market within a few hours of harvest. To maximize supply during the summer, California growers have favored the Long White type because yields per acre are higher than from other varieties.

It has been suggested that a partial solution to the problem would be to modify cultural and production patterns in the state (a) by planting increased acreage to other varieties, (b) by expanding acreage in areas other than the southern San Joaquin Valley, and (c) by shifting to other varieties and other harvesting periods in the San Joaquin Valley.

The difficulty, however, is that these shifts (varietal and seasonal) will give a lower yield per acre. Production costs per acre are probably higher in California than in most other potato producing states, largely because of higher land values and higher costs for water, and because the bulk of potatoes (especially Long Whites) are hand lifted. It is probable that a preharvest irrigation would reduce the harvesting costs per acre and per hundredweight. But in the last analysis, low production costs per hundredweight will depend largely upon yields per acre. The fact that California has consistently led the nation in yields of potatoes per acre has been an important factor in the growth and survival of the potato industry in the state.

Expansion of potato acreage in other sections of the state will take time. If the variety favored for new acreage is also the Long White, this would merely augment supplies of a variety that is not preferred for processing. That would not solve the problem of the southern San Joaquin Valley, and might intensify it, especially if more potatoes become available for the fresh market.

Number, Size, and Location of Plants

Some California potato growers and shippers have been thinking in terms of a single processing plant in Kern County. It has been shown previously that eleven Idaho plants processing dehydrated and frozen potato products handled about 12 million hundredweights of potatoes in 1959, on an average of about one million hundredweights per plant. Moreover, these plants operated 9-10 months of the year.

Because nearly half of the acreage planted to potatoes in California is in Kern County, it is logical, in the beginning at least, that any processing facilities should be in or adjacent to that county. Moreover, Kern County is centrally located with regard to supplies from the Riverside-San Bernardino area and from the central coast area.

If a single plant were established in the Kern County area, it would need a capacity considerably larger than that of the largest plant in Idaho for it to make any considerable dent in the supplies available in the short late-spring season. It would also need extensive refrigerated storage facilities.

It may, of course, be possible to start on a more modest basis with a single plant. Then, as occasion arises, additional plants could be established, some in other potato growing areas of the state. Consideration might also be given to the possibility of processing dehydrated vegetables. As of now, the prospect for dehydration of vegetables other than potatoes does not appear to be bright.

It is unlikely that there will be any considerable substitution by consumers of processed potato products for fresh potatoes until after 1964 or 1965. Furthermore, processing firms in Idaho will probably have to augment their supplies of potatoes from local sources by considerable purchases of potatoes from California. Most of these purchases will be made in April and May, when the supplies of Idaho potatoes are low.

Market Development

A new potato processing firm will undoubtedly experience some difficulty in developing market outlets for its products. It will find that several large, full-line wholesale food manufacturers and distributors have already integrated into potato processing firms in Idaho, Maine, and elsewhere, either by the use of distribution contracts or ownerships. Most of the established firms can provide their customers with a wide variety of dehydrated and/or frozen products, thereby spreading selling costs. The large food manufacturers and distribution firms already have research scientists engaged in quality improvement and testing consumer acceptance. These established firms are in a position to assure, within limits, their trade customers of a continuity of supply of the various products, of quality maintenance, at competitive prices.

Any new firm in California must plan to expend considerable sums in developing a market for its products, unless it can become a supply source for an established manufacturer or distributor of frozen foods. The problem will be more difficult if the California firm markets only a single product or a small range of products, or if there is any question of its ability to remain in business over a period of years.

Capital Requirements and Sources

Two conclusions seem inescapable: first, that the development of potato processing facilities will involve considerable capital expenditures, and second, that processing of potatoes in California will be a high-risk undertaking.

From present knowledge of the technology of processing and marketing potato products, it is safe to say that a single plant in California would require a capital investment of two to three million dollars for buildings, equipment, operating expenses, and market development. Such a plant probably would not make much of a dent in processing the total volume of potatoes produced annually in California. Total capital requirements for a number of modern processing plants might well exceed twenty million dollars. For these reasons, and also because processing techniques are still being evolved, the authors decided that no useful purpose would be served at this stage in presenting detailed specifications regarding size and location of plants, types of equipment needed, processing, transportation, and marketing costs.

Because of the disadvantages of the Long White potato for processing, seasonal concentration of supply, and many other imponderables, it is highly improbable that venture capital could be secured at present by selling securities in the open money market. As growers and shippers of potatoes have the greatest stake in the development of processing facilities in California, it seems inevitable that they must assume much of the cost of developing potato processing in the state.

Fortunately the situation is not critical and does not appear to warrant immediate heavy capital investments in processing facilities. It is unlikely that there will be any extensive substitution by consumers of processed for fresh potatoes until 1964 or 1965. Furthermore, processing firms in Idaho will probably have to augment supplies from local sources during the next few years by purchases of potatoes from California. Most of these purchases would be made during the late spring, when Idaho supplies are low and California supplies are at a peak.

Because of the probability of a period of grace of four or five years, the development of a processing industry in California could be approached on a staged basis. During the first year or two efforts should be concentrated on experiment and research work to test the suitability of California potatoes for processing into a variety of potato products. This could be accompanied by or followed by controlled tests of consumer and trade acceptance. Such experimentation should provide much basic information relative to development of a processing industry in the state. This procedure would have two advantages. First, if the experimental stages indicate that processed potato products can be produced economically in California, it would tend to reduce the risk element in establishing a processing industry in the state; second, such a procedure would require only moderate capital investments.

RECOMMENDATIONS

In view of the above findings, the authors believe that the potato industry of California is confronted with two sets of related decisions. The first is that of financing; the second that of staging.

Financing

Capital will be needed to finance the early development stages. It is suggested that such capital should be raised on an industry basis. Machinery already exists for contributions on an industry basis under the state's marketing laws. These laws permit an industry group to draw up, in consultation with officials of the State Department of Agriculture, a market stabilization and development plan, which could be submitted by referendum to all potato producers and/or shippers. If two-thirds of the producers and/or shippers approve of the plan, the Director of Agriculture would issue a marketing order that would be imposed industry-wide.

Under such a plan, provision could be made for a deduction of one or more cents a hundredweight on all potatoes produced or shipped. Considerable sums of money could be obtained by this means. For example, assuming a marketable production of 20 million hundredweights, a deduction of 2 cents a hundredweight would raise about $400,000 a year. The amount deducted per hundredweight could be varied from year to year, depending on needs for capital. The funds so raised could be administered by an industry board under such conditions and for such purposes as are provided in the marketing order.

Staging

The California potato industry might well consider the feasibility of a three- or four-phase plan to aid in the final decision on whether to establish commercial processing facilities.

Phase 1

It is suggested that the potato industry, or an industry board established under a marketing order, negotiate arrangements with the Western Regional Research Laboratory and the Agricultural Experiment Station of the University of California for research and experimentation on developing new varieties of potatoes, new processing techniques that make better use of existing varieties of potatoes, and improved methods of quality control. Consumer taste preferences might also be included in the testing program. It is not improbable that the research facilities of the U.S. Department of Agriculture may be utilized in measuring consumer acceptance of various experimental products. Even though California potatoes now appear to have many competitive disadvantages from a processing standpoint, it is possible that further research might lead to changes in techniques or the development of new products that might make a processing industry in California economically feasible.

Such cooperative arrangements between the potato industry and research agencies would probably entail only modest expenditures for supply of raw materials, the development of pilot equipment, and for additional personnel.

Phase 2

If the research indicates that it is feasible to process a variety of products from California-grown potatoes, the industry might contract with one or more processing firms in Idaho for actual commercial processing and marketing of products manufactured from California potatoes. Such a contract arrangement would disclose valuable information on processing and marketing costs as well as the need for modification of processing techniques and

products under operational conditions. It is not unlikely that processing firms in Idaho which are affiliated with or owned by full-line food manufacturing firms may be willing to make such a contractual arrangement in order to assure themselves of potential new sources of supply.

Phase 3

This may be regarded as an alternative to the contractual arrangement or as a follow-up of Phase 2. Should the contract route prove unworkable or too costly, the potato industry of California might well consider the establishment of a pilot type of plant, probably in the Bakersfield area. This plant should be designed to test the commercial feasibility of processing and marketing products made from potatoes grown in California. The size and nature of its operations would be predicated to a considerable extent upon information developed under Phase 1. The management of the plant, however, would have the additional responsibility of developing a market for the processed products.

Such a plan would entail a considerable capital investment (possibly running as high as 1.5 million dollars) for plant and equipment, operating expenses, and market development.

Funds for operation under both Phases 2 and 3 could well be supplied under the method of financing already outlined.

Phase 4

This phase has to do with the establishment of commercial potato processing facilities in California. If the results of the contract experimentation with commercial operations indicate that, because of

technical and other disadvantages, California-grown potatoes cannot be processed successfully in competition with potatoes grown and processed elsewhere, the California industry should accept this situation and direct its attention to alternative adjustments.

Even if the results indicate that from the standpoint of product quality and costs a potato processing industry is feasible in California, it may not be wise immediately to establish such an industry if there are indications there is already an overexpansion of processing facilities (nationally and especially in Idaho) and an unbalanced supply-demand situation for processed potatoes. Such an overexpansion of facilities and product supply could result in severe price competition, thereby increasing investment risks and making it desirable to postpone the development of processing facilities in California.

If all relevant factors are satisfactory, however, California growers and shippers should support the establishment of a potato processing industry in or near the Kern County area. Financial participation by growers and shippers would indicate their intention to supply the raw material for processing.

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